Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

U.S. DEPARTMENT OF AGRICULTURE • LIBRARY

U.S. DEPARTMENT OF AGRICULTURE • LIBRARY

USDA, National Agricultural Library
NAL Bldg
10301 Baltimore Blvd
Beltsville, MD 20705-2351

U. S. DEPARTMENT OF AGRICULTURE

OFFICE OF EXPERIMENT STATIONS

BULLETIN No. 16

PROCEEDINGS

OF THE

SIXTH ANNUAL CONVENTION

OF THE ASSOCIATION OF

American Agricultural Colleges and Experiment Stations

HELD AT

NEW ORLEANS, LOUISIANA

NOVEMBER 15–19, 1892

EDITED BY

A. W. HARRIS, for the Office of Experiment Stations

AND

H. E. ALVORD, for the Executive Committee of the Association

PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE

WASHINGTON

GOVERNMENT PRINTING OFFICE

1893

8605

99

U. S. DEPARTMENT OF AGRICULTURE

OFFICE OF EXPERIMENT STATIONS

BULLETIN No. 16

PROCEEDINGS

OF THE

SIXTH ANNUAL CONVENTION

OF THE ASSOCIATION OF

American Agricultural Colleges and Experiment Stations

HELD AT

NEW ORLEANS, LOUISIANA

NOVEMBER 15-19, 1892

EDITED BY

A. W. HARRIS, for the Office of Experiment Stations

AND

H. E. ALVORD, for the Executive Committee of the Association

PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE

WASHINGTON

GOVERNMENT PRINTING OFFICE

1893

OFFICE OF EXPERIMENT STATIONS.

A. W. HARRIS, Director.

A. C. TRUE, Assistant Director and Editor of departments of Botany, Field Crops, and Horticulture.

W. O. ATWATER, Special Editor for Foreign Work.

E. W. ALLEN, Editor of departments of Chemistry, Foods and Animal Production, and Dairying.

W. H. BEAL, Editor of departments of Fertilizers, Soils, and Indexes.

WALTER H. EVANS, Editor of departments of Seeds, Weeds, and Diseases of Plants.

S. L. SOMMERS, Librarian and Record Clerk.

THE AGRICULTURAL EXPERIMENT STATIONS.

ALABAMA—*Auburn:* College Station; W. L. Broun.† *Uniontown:* Canebrake Station; B. M. Duggar.‡

ARIZONA—*Tucson:* F. A. Gulley.*

ARKANSAS—*Fayetteville:* R. L. Bennett.*

CALIFORNIA—*Berkeley:* E. W. Hilgard.*

COLORADO—*Fort Collins:* Alston Ellis.*

CONNECTICUT—*New Haven:* State Station; S. W. Johnson.* *Storrs:* Storrs School Station; W. O. Atwater.*

DELAWARE—*Newark:* A. T. Neale.*

FLORIDA—*Lake City:* O. Clute.*

GEORGIA—*Experiment:* R. J. Redding.*

IDAHO—*Moscow:* C. P. Fox.*

ILLINOIS—*Champaign:* G. E. Morrow.†

INDIANA—*Lafayette:* C. S. Plumb.*

IOWA—*Ames:* James Wilson.*

KANSAS—*Manhattan:* G. T. Fairchild.‖

KENTUCKY—*Lexington:* M. A. Scovell.*

LOUISIANA—*Audubon Park, New Orleans:* Sugar Station. *Baton Rouge:* State Station. *Calhoun:* North Louisiana Station; W. C. Stubbs.*

MAINE—*Orono:* W. H. Jordan.*

MARYLAND—*College Park:* R. H. Miller.*

MASSACHUSETTS—*Amherst:* State Station; C. A. Goessmann.* *Amherst:* Hatch Station; H. H. Goodell.*

MICHIGAN—*Agricultural College:* L. G. Gorton.*

MINNESOTA—*St. Anthony Park:* C. D. Smith.*

MISSISSIPPI—*Agricultural College:* S. M. Tracy.*

MISSOURI—*Columbia:* E. D. Porter.*

NEBRASKA—*Lincoln:* C. L. Ingersoll.*

NEVADA—*Reno:* S. A. Jones.*

NEW HAMPSHIRE—*Durham:* G. H. Whitcher.*

NEW JERSEY—*New Brunswick:* State Station; E. B. Voorhees.* *New Brunswick:* College Station; A. Scott.*

NEW MEXICO—*Las Cruces:* H. Hadley.*

NEW YORK—*Geneva:* State Station; P. Collier.* *Ithaca:* Cornell University Station; I. P. Roberts.*

NORTH CAROLINA—*Raleigh:* H. B. Battle.*

NORTH DAKOTA—*Fargo:* J. B. Power.*

OHIO—*Wooster:* C. E. Thorne.*

OKLAHOMA—*Stillwater:* J. C. Neal.*

OREGON—*Corvallis:* J. M. Bloss.*

PENNSYLVANIA—*State College:* H. P. Armsby.*

RHODE ISLAND—*Kingston:* C. O. Flagg.*

SOUTH CAROLINA—*Fort Hill:* J. S. Newman.‖

SOUTH DAKOTA—*Brookings:* L. McLouth.‖

TENNESSEE—*Knoxville:* C. F. Vanderford.*

TEXAS—*College Station:* J. H. Connell.*

UTAH—*Logan:* J. W. Sanborn.*

VERMONT—*Burlington:* J. L. Hills.*

VIRGINIA—*Blacksburg:* J. M. McBryde.*

WASHINGTON—*Pullman:* J. W. Heston.*

WEST VIRGINIA—*Morgantown:* J. A. Myers.*

WISCONSIN—*Madison:* W. A. Henry.*

WYOMING—*Laramie:* A. A. Johnson.‖

---

*Director.
†President of board of direction.
‡Assistant director in charge.
§Acting director.
‖Chairman of council.

CONTENTS.

	Page.
Letter of transmittal	6
Constitution of the Association of American Agricultural Colleges and Experiment Stations	7
Officers of the association	11
List of delegates in attendance	13
Call for the convention	16
Programs	17
Proceedings:	
Report of the executive committee	21
Report of the Section on College Work	24
Report of the Section on Agriculture	28
Report of the Section on Botany	33
Report of the Section on Chemistry	36
Report of the Section on Entomology	41
Annual address of President	58
The relation of technical to general courses of study. By D. G. Fairchild	67
The treatment of apple scab. By E. S. Goff	87
A comparative test of fungicides in checking potato blight and rot. By L.R. Jones	89
A study of fruit decays. By B. D. Halsted	91
Notes on the breeding of fruits. By N. E. Hansen	92
The crossing of cucurbits. By L. H. Pammel	94
Report of committee on the coöperative station exhibit at the World's Columbian Exposition	99
Report of the committee on the collective college exhibit at the World's Columbian Exposition	103
Report of committee on World's Agricultural Congress	104
Report of committee on coöperation with the Weather Bureau	106
The relation of the agricultural and mechanical colleges to the Departn ent of the Interior	114
Appendix:	
The Section on Agriculture and Chemistry	129
Grass gardens—methods and purposes. By W. M. Hays	130
Advances in agricultural education. By W. M. Hays	132
The bulletin—present and prospective. By C. L. Ingersoll	138
What shall the professor of agriculture teach? By P. M. Harwood	139
Methods of irrigation. By L. G. Carpenter	142
Forage plants for the semiarid West. By C. C. Georgeson	145
The establishment of official methods of experimentation. By F. A. Gulley	147
What is the live weight of an animal? By H. J. Patterson	150
Physical tests of soils. By R. H. Loughridge	156
Suggested experiments in breeding. By William H. Brewer	162
The Section on Horticulture	167
The Section on Botany	168

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., August 15, 1893.

SIR: I have the honor to transmit herewith for publication Bulletin No. 16 of this Office, containing the proceedings of the sixth annual convention of the Association of American Agricultural Colleges and Experiment Stations, held at New Orleans, La., November 15–19, 1892. The stenographic report of this meeting was made by Mr. S. E. Black, of this Office.

Respectfully,

A. W. HARRIS,
Director.

Hon. J. STERLING MORTON,
Secretary of Agriculture.

CONSTITUTION

OF THE

ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.

NAME.

This Association shall be called The Association of American Agricultural Colleges and Experiment Stations.

OBJECT.

The object of this Association shall be the consideration and discussion of all questions pertaining to the successful progress and administration of the colleges and stations included in the Association, and to secure to that end mutual coöperation.

MEMBERSHIP.

(1) Every college established under the act of Congress approved July 2, 1862, or receiving the benefits of the act of Congress approved August 30, 1890, and every agricultural experiment station established under State or Congressional authority, the Bureau of Education of the Department of the Interior, the Department of Agriculture, and the Office of Experiment Stations of the last-named Department, shall be eligible to membership in this Association.

(2) Any institution a member of the Association in full standing may send any number of delegates to the meetings of the Association, but one shall be designated to the Association as the regular representative and voting delegate. The same delegate may represent both a college and a station, but shall cast only one vote in general sessions. Other delegates may be designated by any institution to represent it in specified sections of the Association, but such delegates shall vote only in such sections, and no institution shall be allowed more than one vote in any sectional meeting.

(3) Delegates from other institutions engaged in educational or experimental work in the interest of agriculture or mechanic arts may, by a majority vote, be admitted to conventions of the Association, with all privileges except the right to vote.

(4) In like manner, any person engaged or directly interested in agriculture or mechanic arts, who shall attend any convention of this Association, may be admitted to similar privileges.

SECTIONS.

(1) The Association shall be organized into sections upon (1) college work; (2) agriculture and chemistry; (3) horticulture and botany; (4) entomology; (5) mechanic arts. The executive committee shall, upon the request of any ten institutions represented in the Association, provide for the organization of provisional sections at any convention.

(2) Each section shall conduct its own proceedings and shall keep record of the same, and present a synopsis thereof to the Association at the close of every convention; and no action of a section, by resolution or otherwise, shall be valid until the same shall have been ratified by the Association in general session.

MEETINGS.

(1) This Association shall hold at least one meeting in every calendar year, to be designated as the annual convention of the Association. Special meetings may be held at other times, upon the call of the executive committee, for purposes to be specified in the call.

(2) The annual convention of the Association shall comprise general sessions and meetings of the sections, and provision shall be made therefor in the program. The section meetings may be simultaneous or otherwise, at the discretion of the executive committee, but at least two sections of the Association, to be designated each year by the executive committee, shall present in general session of each convention a portion of the subjects coming before them.

OFFICERS.

(1) The general officers of this Association shall be a president, five vice-presidents, a bibliographer, and a secretary, who shall also be treasurer. The president, junior ex-president, the secretary, and four persons to be chosen by the Association shall constitute an executive committee, which shall elect its own chairman.

(2) Each section shall, by ballot, nominate to the Association in general session, for its action, a chairman and a secretary for such section.

(3) Officers shall be chosen by ballot at the annual convention of the Association, and shall hold office from the close of the convention at which they are elected until their successors shall be chosen.

(4) Any person being an accredited delegate to an annual meeting of the Association, or an officer of an institution which is a member of the Association in full standing at the time of election, shall be eligible to office.

DUTIES OF OFFICERS.

(1) The officers of the Association shall perform the duties which usually devolve upon their respective offices.

(2) The president shall deliver an address at the annual convention before the Association in general session.

(3) The chairman of each section shall make, at the annual convention, a report to the Association in general session of the progress during the preceding year of the subject or subjects appertaining to his section, and such reports shall not occupy more than twenty minutes each.

(4) The executive committee shall determine the time and place of the annual conventions and other meetings of the Association, and shall, between such conventions and meetings, act for the Association in all matters of business. It shall issue its call for the annual conventions of the Association not less than sixty days before the date on which they are to be held, and for special meetings not less than ten days before such dates. It shall be charged with the general arrangement and conduct of all meetings called by it. It shall designate the two sections to present in general session a portion of the subjects coming before them, and shall give notice thereof to the chairmen of such sections at least ninety days prior to the annual convention. It shall provide a well-prepared order of business and a program of exercises, and shall make a seasonable issue of said program. Said committee may fill any vacancy in an office or committee of the Association occurring after the adjournment of the annual convention, such appointee to serve until the next annual election.

FINANCES.

At every annual convention, the Association, in general session, shall provide for obtaining the funds necessary for its legitimate expenses, and may, by appropriate action, call for contributions upon the several institutions eligible to membership; and no institution shall be entitled to representation or participation in the benefits of the Association unless such institution shall have made the designated contribution for the year previous to that in and for which such question of privilege shall arise, or shall have had said payment remitted by the unanimous vote of the executive committee.

AMENDMENTS.

This constitution may be amended at any regular convention of the Association by a two-thirds vote of the delegates present, if the number constitute a quorum: *Provided*, That notice of any proposed amendment, together with the full text thereof and the name of the mover, shall have been given in the call for the convention. Every such proposition of amendment shall be subject to modification or amendment in the same manner as other propositions, and the final vote on the adoption or rejection shall be taken by yeas and nays of the institutions then and there represented.

RULES OF ORDER.

(1) The executive committee shall be charged with the order of business, subject to special action of the convention, and this committee may report at any time.

(2) All business or topics proposed for discussion and all resolutions submitted for consideration of the convention shall be read and then referred, without debate, to the executive committee, to be assigned positions on the program.

(3) Speakers invited to open discussions shall be entitled to twenty minutes each.

(4) In general discussions the ten-minute rule shall be enforced.

(5) No speaker shall be recognized a second time on any one subject while any delegate who has not spoken thereon desires to do so.

(6) The hours of meeting and adjournment adopted with the general program shall be closely observed, unless changed by a two-thirds vote of delegates present.

(7) The presiding officer shall enforce the parliamentary rules usual in such assemblies and not inconsistent with the foregoing.

OFFICERS OF THE ASSOCIATION.

ELECTED AT WASHINGTON, D. C., AUGUST, 1891.

President,

W. L. BROUN, of Alabama.

Vice-Presidents,

C. W. DABNEY, jr., of Tennessee; H. E. STOCKBRIDGE, of North Dakota;
J. W. NICHOLSON, of Louisiana; F. E. EMERY, of North Carolina;
W. H. JORDAN, of Maine.

Secretary and Treasurer,

M. A. SCOVELL, of Kentucky.

Executive Committee,

The PRESIDENT; the SECRETARY;
H. E. ALVORD, of Maryland; J. A. MYERS, of West Virginia;
H. H. GOODELL, of Massachusetts; W. FREAR, of Pennsylvania;
A. T. NEALE, of Delaware.

Chairmen of Sections,

Agriculture, C. L. INGERSOLL, of Nebraska; College Work, E. M. TURNER, of West Virginia;
Botany, GEO. F. ATKINSON, of Alabama; Entomology, L. BRUNER, of Nebraska;
Chemistry, M. A. SCOVELL, of Kentucky; Horticulture, E. A. POPENOE, of Kansas.

Secretaries of Sections,

Agriculture, T. F. HUNT, of Pennsylvania; College Work, H. E. STOCKBRIDGE, of North Dakota;
Botany, L. H. PAMMEL, of Iowa; Entomology, F. M. WEBSTER, of Ohio;
Chemistry, H. H. HARRINGTON, of Texas; Horticulture, T. L. BRUNK, of Maryland.

ELECTED AT NEW ORLEANS, LA., NOVEMBER, 1892.

President,

W. A. HENRY, of Wisconsin.

Vice-Presidents,

W. C. STUBBS, of Louisiana; J. A. MYERS, of West Virginia;
E. W. HILGARD, of California; A. Q. HOLLADAY, of North Carolina;
J. F. HICKMAN, of Ohio.

Secretary and Treasurer,

M. A. SCOVELL, of Kentucky.

Bibliographer,

S. W. JOHNSON, of Connecticut.

Executive Committee,

The PRESIDENT; the JUNIOR EX-PRESIDENT; the SECRETARY;
H. E. ALVORD, of the District of Columbia;
H. H. GOODELL, of Massachusetts;
JAS. NEILSON, of New Jersey;
C. W. DABNEY, jr., of Tennessee.

Chairmen of Sections,

Agriculture and Chemistry, W. A. HENRY, of Wisconsin;
Botany and Horticulture, F. LAMSON-SCRIBNER, of Tennessee;
College Work, C. W. DABNEY, jr., of Tennessee;
Entomology, L. BRUNER, of Nebraska;
Mechanic Arts, C. W. HALL, of Minnesota.

Secretaries of Sections,

Agriculture and Chemistry, W. C. LATTA, of Indiana;
Botany and Horticulture, E. S. GOFF, of Wisconsin;
College Work, M. C. FERNALD, of Maine;
Entomology, F. M. WEBSTER, of Ohio;
Mechanic Arts, F. P. ANDERSON, of Kentucky.

LIST OF DELEGATES AND VISITORS IN ATTENDANCE.

Alabama:

College: W. L. Broun, president; P. H. Mell, professor of natural history and geology.

Station (Auburn): A. J. Bondurant, agriculturist; N. T. Lupton, chemist.

Canebrake Station: J. Huggins, trustee; B. M. Duggar, assistant director.

Arizona:

Station: F. A. Gulley, director.

Arkansas:

College: E. H. Murfee, president.

California:

College: R. H. Loughridge, professor of geology and chemistry.

Colorado:

College: L. G. Carpenter, professor of physics and irrigation engineering.

Station: W. J. Quick, director.

Connecticut:

State Station: S. W. Johnson, director.

Storrs Station: C. D. Woods, vice-director and chemist.

Delaware:

Station: A. T. Neale, director.

Florida:

Station: J. P. De Pass, director.

Georgia:

College: J. B. Hunnicutt, professor of agriculture.

Station: R. J. Redding, director; Gustav Speth, horticulturist.

Illinois:

College: G. E. Morrow, professor of agriculture.

Station: G. W. McCluer, assistant horticulturist.

Indiana:

College: J. H. Smart, president; H. A. Huston, professor of agricultural chemistry.

Station: C. S. Plumb, director.

Iowa:

College: H. Osborn, professor of zoölogy and entomology.

Station: L. H. Pammel, botanist.

Kansas:

College: G. T. Fairchild, president.

Station: C. C. Georgeson, agriculturist.

Kentucky:

College: J. K. Patterson, president.

Station: M. A. Scovell, director.

Louisiana:

College (Baton Rouge): J. W. Nicholson, president; B. B. Ross, professor of chemistry and mineralogy; H. A. Morgan, professor of horticulture and entomology.

Louisiana—Continued.

College (Southern University, New Orleans): H. A. Hill, president; V. L. Roy, professor of chemistry; W. J. Nickerson, principal of music department; J. M. Henry, professor of mathematics, Latin and Greek; H. Jamieson, professor of agriculture.

Station (Audubon Park, New Orleans): W. C. Stubbs, director; T. P. Hutchinson, assistant director; J. T. Crawley, chemist; F. H. Burnette, chemist; R. T. Burwell, machinist; J. N. Roussell, sugar-maker; Lucien Soniat, trustee.

Station (Baton Rouge): D. N. Barrow, assistant director; R. E. Blouin, assistant chemist.

Station (Calhoun): J. G. Lee, assistant director.

Tulane University: W. P. Johnston, president; B. V. B. Dixon, professor of metaphysics; J. H. Dillard, professor of Latin; R. Sharp, professor of English; J. B. Ficklen, professor of history; J. H. Deiler, professor of German; A. Fortier, professor of French; J. L. Cross, professor of mathematics; B. Ayres, professor of physics; J. M. Ordway, professor of applied chemistry; H. B. Orr, professor of biology; W. Woodward, professor of Greek; J. W. Pearce, professor of Anglo-Saxon; C. T. Gill, professor of Greek; W. J. Cooper, professor of mechanical engineering; W. Von Phul, professor of physics; T. T. Hall, mechanician; W. O. Rogers, secretary; A. D. Hurt, assistant secretary; D. S. Anderson, instructor.

Maine:

College: M. C. Fernald, president.

Station: W. M. Munson, horticulturist.

Maryland:

Station: R. H. Miller, director; H. J. Patterson, chemist.

Massachusetts:

College: H. H. Goodell, president.

Michigan:

College: O. Clute, president; I. H. Butterfield, trustee; H. Chamberlain, trustee.

Station: P. M. Harwood, agriculturist.

Minnesota:

College: C. W. Hall, dean.

Mississippi:

College: S. D. Lee, president; T. Butler, professor of veterinary science; A. B. McKay, professor of horticulture.

Station: S. M. Tracy, director; W. L. McGee, assistant director; E. R. Lloyd, agriculturist; H. E. Weed, entomologist.

Alcorn College: J. D. Burrus, professor of agriculture and mathematics.

Station (Ocean Springs): F. S. Earle, superintendent.

Missouri:

College: E. D. Porter, dean.

Nebraska:

College: C. L. Ingersoll, dean.

Nevada:

Station: N. E. Wilson, chemist.

New Jersey:

College: Austin Scott, president; B. D. Halsted, professor of botany.

Station: James Neilson, acting director.

New Hampshire:

Station: G. H. Whitcher, director.

New Mexico:

College: H. Hadley, president; W. L. Rynerson, trustee.

New York:

College: I. P. Roberts, professor of agriculture.

Station: H. H. Wing, agriculturist.

North Carolina:

College: A. Q. Holladay, president.

Station: B. W. Kilgore, assistant chemist.

North Dakota:

College: W. M. Hays, professor of agriculture.

Ohio:

College: R. H. Warder, trustee; T. F. Hunt, professor of agriculture.

Station: C. E. Thorne, director; J. F. Hickman, agriculturist.

Oklahoma:

College: J. C. Neal, professor of natural science.

Pennsylvania:

College: G. W. Atherton, president.

Station: H. P. Armsby, director; W. Frear, vice director and chemist.

Rhode Island:

College: J. H. Washburn, president.

Station: C. O. Flagg, director.

South Carolina:

Station: J. S. Newman, vice director and agriculturist.

Tennessee:

College: C. W. Dabney, jr., president.

Station: F. Lamson-Scribner, director and botanist; C. F. Vanderford, assistant director.

Texas:

College: W. R. Cavitt, trustee.

Station: G. W. Curtis, director and agriculutrist.

Utah:

College: J. W. Sanborn, president.

Vermont:

Station: W. W. Cooke, director.

West Virginia:

College: E. M. Turner, president.

Station: J. A. Myers, director.

Wisconsin:

College: E. S. Goff, professor of horticulture and economic entomology; F. H. King, professor of agricultural physics; H. B. Dale, trustee.

Station: W. A. Henry, director; F. W. Woll, assistant chemist.

Wyoming:

College: A. A. Johnson, president.

U. S. Department of Agriculture:

H. W. Wiley, chemist; H. E. Alvord, special agent.

Office of Experiment Stations:

A. W. Harris, director; A. C. True, assistant director; E. W. Allen, editor; S. E. Black, private secretary.

Bureau of Education:

J. W. Holcombe, chief clerk.

Visitors:

Mrs. N. T. Lupton, Mrs. P. H. Mell, Mrs. V. M. Fleming, J. F. Merry, N. S. Dougherty (secretary Louisiana Bureau of Agriculture), J. B. Buchanan (of the New Orleans Academy of Science), W. Murray, J. W. Coleman, Mrs. C. L. Ingersoll, Mrs. J. S. Newman, Mrs. J. A. Myers.

CALL FOR THE CONVENTION.

ASSOCIATION OF AMERICAN AGRICULTURAL
COLLEGES AND EXPERIMENT STATIONS,
OFFICE OF THE EXECUTIVE COMMITTEE,
Washington, D. C., August 1, 1892.

By authority of the executive committee, a delegate convention of this association is hereby called to meet in the city of New Orleans, La., on Tuesday, November 15, 1892, at noon.

The headquarters of the association during this convention will be at the St. Charles Hotel.

The program for the sessions and other particulars will be announced later.

At any regularly called meeting of the association each college established under the act of Congress approved July 2, 1862, and each experiment station established under State or Congressional authority, and the Department of Agriculture shall be entitled to one delegate, but no delegate shall cast more than one vote. Other institutions engaged in experimental work in the interest of agriculture may be admitted to representation in this association by a majority vote at any regular meeting of the association. (Extract from constitution.)

In accordance with the requirements of the constitution, the sections on botany and college work are hereby designated to present a portion of the subjects coming before them in the general sessions of the convention.

The chairmen of the several sections will each be called upon for a report of progress, not to exceed fifteen minutes in the reading, during the first day of general sessions.

Conforming to the action of the Washington convention of 1891 (see Proceedings, p. 61), there will be submitted, in connection with the program for the convention of 1892, such amendments to the constitution of the association as are deemed desirable by the executive committee, and the consideration of this subject will be assigned a place in the program.

For the executive committee:

HENRY E. ALVORD,
Chairman.

PROGRAMS.

Places and Hours of Meeting.

All sessions will be held at Tulane University, corner of Common and Baronne streets, two squares from the St. Charles Hotel.

Rooms for the section meetings will be duly designated.

Hours for meetings, 9 a. m., 2 p. m., and 7:30 p. m.

Headquarters for delegates when not in session, St. Charles Hotel, on St. Charles street, between Common and Gravier streets and one square from the canal.

Special Notice.

The chairmen and secretaries of sections are requested to hand to the secretary of the association, well in advance, written announcements to be made on behalf of the sections from day to day; also to preserve such records of the section meetings as will serve for a correct journal of their proceedings.

Tuesday, November 15, 1892.

10 a. m.—Meeting of the executive committee, at the St. Charles Hotel.

12 m.—General session. Opening exercises and reports of committees.

2 p. m.—General session. Reports from chairmen of the sections.

7:30 p. m.—Meetings of all sections for organization and preliminary business.

8 p. m.—General session. Annual address by the president of the association, William LeRoy Broun, LL. D., president Agricultural and Mechanical College of Alabama.

Wednesday, November 16.

9 a. m.—General session. Miscellaneous business. Report of committee on amendments to the constitution and action thereon.

10 a. m.—Meetings of the sections on agriculture, botany, and entomology; others if desired.

1 p. m.—Visit to the Louisiana Sugar Experiment Station, Audubon Park.

7:30 p. m.—General session. Subjects presented by the section on botany, Prof. G. F. Atkinson, Cornell University, chairman. Discussion of the publication of the stations, to be opened by Director A. W. Harris, of the U. S. Department of Agriculture, and Director W. A. Henry, of Wisconsin.

Thursday, November 17.

9 a. m.—General session. Appointment of committees. Resolutions considered. Discussion: The Association and the World's Columbian Exposition, with reports of standing committees and incidental business. Upon adjournment of the general session, meetings of the sections on chemistry, college work, and horticulture.

2 p. m.—Meetings of all the sections.

7:30 p. m.—General session. Consideration of resolutions and general business. Annual election of officers. Reports from sections and action thereon. Subjects

presented by the section on college work, President E. M. Turner, University of West Virginia, chairman. Discussion: The Relations of the Colleges to the Department of the Interior, with an address by John W. Holcombe, chief clerk, Bureau of Education, representing the Department.

FRIDAY, NOVEMBER 18.

Excursion by special train to Baton Rouge, with visits to the State Agricultural and Mechanical College, the State Agricultural Experiment Station, and several sugar plantations and sugarhouses in operation. Complimentary dinner at Baton Rouge.

Section meetings to be announced. Final adjournment.

SECTION ON AGRICULTURE.

C. L. INGERSOLL, of Nebraska, chairman. T. F. HUNT, of Ohio, secretary.

(1) Number of animals in a feeding experiment. C. S. Phelps.
(2) Individual variation in cows. G. W. Curtis.
(3) What is the live weight of an animal? H. J. Patterson.
(4) Stock-breeding at experiment stations. W. H. Brewer.
(5) Breed tests. W. W. Cooke and E. B. Voorhees.
(6) Mistakes to avoid in dairy experiments. H. H. Wing and W. H. Jordan.
(7) Mistakes in feeding young animals. I. P. Roberts.
(8) Technique in agricultural experimentation. J. F. Hickman.
(9) The establishment of official methods of experimentation. W. A. Henry and F. A. Gulley.
(10) Testing new varieties prior to their introduction. H. J. Waters.
(11) Coöperative field experiments. H. B. Batt'e and F. D. Gardner.
(12) Grass gardens, methods and purposes. H. P. Armsby and W. M. Hays.
(13) Forage-plant tests, their scope and plan. C. C. Georgeson.
(14) The botany of the cowpea. S. M. Tracy.
(15) Methods of soil investigation. F. H. King and M. Whitney.
(16) The control of soil moisture. D. McLaren.
(17) Methods of irrigation. L. G. Carpenter.
(18) What should the professor of agriculture teach? G. E. Morrow and P. M. Harwood.
(19) Laboratory instruction in agriculture. J. S. Newman.
(20) Details of successful farmer education. W. M. Hays.
(21) The relation of the experiment station to the agricultural college. L. Foster.
(22) The field of bulletins, present and prospective. C. L. Ingersoll.
(23) The press bulletin. C. E. Thorne.
(24) Methods of testing farm implements. J. W. Sanborn.
(25) Fiber production. G. Vasey and C. D. Smith.
(26) The production of beet sugar. E. W. Hilgard and J. Wilson.

NOTE.—This section program is published as furnished by the section officers. The executive committee requests that topic No. 14 be presented in the section on botany, Nos. 18, 19, and 20 in the section on college work, and Nos. 21, 22, and 23 in general sessions, unless a new section should be organized on station administration.

SECTION ON BOTANY.

GEO. F. ATKINSON, of New York, chairman. L. BRUNER, of Nebraska, secretary.

(1) New Jersey peronosporeæ for 1892. B. D. Halsted.
(2) New or little-known weed fungi. B. D. Halsted.

(3) Fruit rots, a study. B. D. Halsted.
(4) The rusts of the cereals. H. L. Bolley.
(5) Résumé of original work in potato scab. H. L. Bolley.
(6) Notes on destruction of some fungi. H. L. Bolley.
(7) Clover in North Dakota. H. L. Bolley.
(8) Some experiments in the prevention of *Cucospora ribes* and *Cylindrosporium radi*. L. H. Pammel.
(9) A ruta-baga rot. L. H. Pammel.
(10) Crossing of cucurbits. L. H. Pammel.
(11) Treatment of grape and tomato diseases. G. McCarthy.
(12) Method for obtaining a pure culture of Pammel's fungus of root rot of cotton. George F. Atkinson.
(13) A new damping-off fungus. George F. Atkinson.
(14) Contribution to the biology of the organisms causing root tubercles of leguminous plants. George F. Atkinson.

LOCAL PROGRAM.

Tuesday, November 15, 1892.

Opening session.
Addresses of welcome:
On the part of the State, Hon. M. J. Foster, governor.
On the part of the city, Hon. J. Fitzpatrick, mayor.
On the part of Tulane University, Col. W. P. Johnston, president of the University.
Responses.
Business of the convention.

EVENING SESSION.

Annual address of William Le Roy Broun, LL. D., of Alabama, president of the Association.

Wednesday, November 16.

9 a. m.—General session.
1 p. m.—Visit to the Louisiana Sugar Experiment Station, Audubon Park.
7:30 p. m.—General session.

Thursday, November 17.

9 a. m.—General session.
1 p. m.—Excursion on steamer *War Eagle* to Chalmette and Southport.
7:30 p. m.—General session.

Friday, November 18.

7 a. m.—Excursion to Baton Rouge, stopping en route at several sugar houses in operation, by the Mississippi and Yazoo Valley Railroad.
1 p. m.—Arrival and dinner at Baton Rouge.
2 p. m.—Visit to the Agricultural and Mechanical College and State Experiment Station.
4 p. m.—Leave for New Orleans.
7 p. m.—Arrive in New Orleans.

The public are invited to attend all the exercises of the convention, and especially those of the first day.

PROCEEDINGS.

Morning Session, Tuesday, November 15, 1892.

The convention was called to order at 12:10 p. m., in the lecture hall of Tulane University, by President Broun.

Prayer was offered by the Rev. B. M. Palmer, D. D., and addresses of welcome were delivered by Hon. M. J. Foster, governor of the State, by Hon. J. Fitzpatrick, mayor of the city of New Orleans, and by Col. W. P. Johnston, President of Tulane University. Responses were made by the president of the Association, by Mr. Atherton, of Pennsylvania, and by Mr. Chamberlain, of Michigan.

The report of the executive committee was submitted by H. E. Alvord, chairman.

Report of the Executive Committee.

This committee met in Washington immediately after the adjournment of the convention of 1891, and organized by electing H. E. Alvord as chairman, and M. A. Scovell as secretary.

The committee has performed the duties with which it was charged by the last convention, and in accordance with the constitution of the Association has called the present meeting and made the necessary arrangements therefor. In this connection the very cordial and efficient local aid which has been rendered in New Orleans, under the energetic leadership of Director Stubbs, deserves appreciative recognition.

Comparatively little work has been necessary at Washington on behalf of the Association during the past year, either before Congress or the Executive Departments, and yet the influence of the Association has unquestionably aided in securing prompt payments from the United States Treasury to the colleges and stations; in maintaining the advance payments to the latter; in providing for the continued support and additional efficiency of the Office of Experiment Stations; and in obtaining a special appropriation for the Weather Bureau, to be used in work on the borders or common ground of meteorology and agriculture.

The committee has given especial attention to the several subjects referred to it by the Washington convention of 1891, and particularly the instructions relating to the proposed work of the Association at the World's Columbian Exposition at Chicago next year.

The question of the location of the collective exhibit of the colleges and stations was settled early in the year to the entire satisfaction of all parties concerned, and in the agricultural building of the Exposition a space has been definitely assigned

ample in area and admirable in position. Immediately adjoining space has been assigned to Germany and France in which to exhibit what these countries are doing for agricultural investigation and instruction. This fact should be an incentive to every institution affiliated with this Association to do its full share in order that the work of our American colleges and stations may be shown to compare favorably with that of foreign lands. No such opportunity of making this comparison where it will impress the people of this and other countries is likely to occur again for many years.

The work of preparing the coöperative exhibit of the experiment stations has moved steadily forward, and great credit is due to the standing committee of the Association having this matter in charge as well as to the Department of Agriculture for its generous and effective coöperation. A report of progress will be made by Director Armsby, the chairman of the standing committee.

The instructions of the last convention, as shown in the printed Proceedings, pp. 72 and 73, were carried out by the executive committee in the appointment of President Atherton, of Pennsylvania, President Smart, of Indiana, and Prof. Morrow, of Illinois, as the special committee to consider the subject of a collective agricultural college exhibit in connection with the station exhibit already determined upon, and with power to act for the Association in the premises. This committee canvassed the subject and received such encouragement from the various institutions as to lead to the decision to proceed with the work of preparing such an exhibit. President Atherton later found the condition of his health and the pressure of home duties to be such as to necessitate his retirement from this committee. The chairmanship was then urged upon President Smart, but he for like reasons, felt compelled to decline and also to wholly retire from the work. Prof. Morrow was carrying such a burden of Exposition work in Illinois, as to be able to act on this committee only in an advisory capacity. The executive committee keenly felt the loss of the services of these efficient officers in this important undertaking, and as the time for the present convention was approaching it was decided not to reorganize this special committee, but to have the executive committee itself continue the work until further instructions from the Association. This has accordingly been done and a report of progress will be made by the chairman.

The special committee appointed by the Association to coöperate with the Congress Auxiliary of the Exposition in relation to agricultural congresses has been actively engaged, and its work will be reported by the chairman, Prof. Morrow.

After the adjournment of the last Washington convention the Association was invited to send one delegate to a conference arranged by the officials of the Exposition and the Columbian Dairy Association, for the purpose of formulating rules to govern the proposed tests of dairy cows at Chicago. Director Scovell, of Kentucky, secretary of the Association, was designated for this service by the executive committee, and his services in that capacity were most useful and influential. The reception of this delegate and the position accorded him in that conference was a notable recognition of this Association. Still more so is the final adoption by the Exposition authorities of the rules governing dairy tests, substantially as framed by that conference, and which provide that the committee to supervise the tests at Chicago shall have as its nucleus four representatives of this Association.

The executive committee has received from the chief of the department of agriculture of the World's Columbian Exposition formal communications addressed to this Association, requesting it to nominate four representatives of our body, to be appointed by the Exposition authorities to supervise the tests of dairy cows, and also to appoint a committee of the Association to confer with Chief Buchanan regarding a course of popular agricultural lectures to be delivered during the Exposition in the Agricultural Building.

This action throws upon the Association a very grave responsibility, making it virtually the arbiter in the most important and most carefully prepared experiment

in comparing the dairy breeds of cattle that has ever been undertaken. Various questions of duty, of expediency, and of ways and means arise in this connection which should receive the serious attention of this convention.

The executive committee has therefore assigned for Thursday morning next the consideration of the subject, "The Association and the World's Columbian Exposition," with all the incidental questions, and all delegates are requested to prepare for full discussion and appropriate action upon this very important matter.

Conforming to the action of the last convention, the executive committee has fully considered the subject of amending the constitution of the Association, and as a result it submits to this convention, in connection with the program for its proceedings, a printed draft of a constitution which is recommended for adoption as a substitute, entire, for the existing instrument. Action upon this subject is assigned for the general session of Wednesday morning.

The Washington convention appointed a special committee of three to confer with the officials of the Department of Agriculture upon the development and extension of the Weather Bureau in the special interests of agriculture. This committee has performed the duty assigned and will report thereon to this convention.

In accordance with the action of the section of college work during the last convention, confirmed by the Association, the annual reports to the Department of the Interior, from the presidents and treasurers of colleges, have been formulated, through the cordial coöperation of the Bureau of Education, to the satisfaction of all concerned. The relations of the colleges to this Department, through the Bureau of Education, as its agency for communication, have been agreeable and free from friction. Yet it is found that the new and arduous duties devolving upon this Bureau under the operations of the (so-called) new Morrill act, have to be performed without special provision therefor, and it is evident that many mutual advantages would accrue from some such additional organization as was made for the stations in the establishment of the Office of Experiment Stations in the Department of Agriculture. This is a subject which seems to be worthy of special consideration by this convention; accordingly a suitable assignment has been made for the general session Thursday evening, and in this connection the special representative of the Department of the Interior has been invited to address the Association at that time.

Other details of the proposed proceedings of the present convention will be found in the printed program, which is now formally submitted and recommended for adoption. It is also recommended that the rules of order which have governed former conventions be continued in force, and that, as heretofore, the executive committee be authorized to receive all credentials and prepare the official roll of delegates.

The contribution of $10 for the year from each institution eligible to membership in the Association, as agreed upon at the last convention, has been very generally paid, and has created a revenue sufficient for the requirements of an economical administration. The principal disbursements the past year have been for the necessary expenses of committees while in the discharge of their duties. The treasurer's report will show a balance from last year of $309.49, to which is added $1,130 for collections, making the total receipts $1,439.49; disbursements in all amounted to $1,022.95, leaving a balance on hand of $416.54 at the opening of this convention. It seems evident that the Exposition work of the coming year will involve additional and unusual expenditures, which the Association should consider and provide for before adjournment.

Respectfully submitted for the executive committee.

HENRY E. ALVORD,
Chairman.

NEW ORLEANS, LA., *November 15, 1892.*

The report was accepted and ordered on file.

On motion of Mr. Atherton the action of the executive committee in assuming charge of the preparation of the collective college exhibit for the World's Columbian Exposition was approved, and the committee was instructed to continue that work.

The report of the treasurer was then presented by Mr. Scovell.

The report was received and referred to an auditing committee, consisting of Messrs. Hadley, Hunt, and Newman.

Mr. SMART. I have suffered much from colleagues in search of information and I feel like making a protest. I have received within the last four months thirteen requests from thirteen different institutions for information about the institution I represent. One bookkeeper wants the college accounts to the 1st of January and another to the 1st of July. I think such information ought to be supplied, and that it can be if we make proper arrangements. I move, therefore, that a committee be appointed by the chair to consider the subject of college statistics and to devise means for securing and distributing them.

The motion was carried, and the chair appointed Messrs. Smart, Atherton, and Goodell.

Mr. Alvord, chairman of the executive committee, announced that the convention had been invited through special committees to visit the cotton exchange, the sugar exchange, and the board of trade, and that Mr. Stubbs would furnish permits to visit the large sugar refineries of the city.

On motion of Mr. Alvord, representatives of the cotton exchange, sugar exchange, board of trade, Academy of Science of New Orleans, Tulane University, Illinois Central Railroad, and any other railroads having agricultural interests were invited to sit with the delegates in general sessions and in the sections.

The secretary requested delegates and visitors to register at once and get their numbered badges.

The convention adjourned at 2 p. m.

AFTERNOON SESSION, TUESDAY, NOVEMBER 15, 1892.

The meeting was called to order by the president at 3:40 p. m.

A letter inviting the Association to visit the Southern University was read by the secretary. On motion of Mr. Alvord, the invitation was accepted for Wednesday afternoon.

Mr. Turner, chairman of the section on college work, read his report, as follows:

REPORT OF THE SECTION ON COLLEGE WORK.

In presenting this report an explanation of its incomplete character is due the Association. On October 10 I addressed a circular letter of inquiry to the president of each college in the Association, asking for the information deemed necessary for this report. Replies to that circular have been received from twenty-five colleges. Some of these replies were so general that they could not be used for the purposes of this

report. The colleges reporting were Arizona, Delaware, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Massachusetts, Michigan, Minnesota, Mississippi, Nebraska, Nevada, New Hampshire, New York, North Dakota, Ohio, Oregon, Rhode Island, South Carolina, South Dakota, Tennessee, Utah, and West Virginia.

The inquiries submitted were in reference to increase in attendance, graduates, additions to the faculty, new courses of study, new buildings and equipment, and proposed improvements.

In reply to the first question, which was as to the increase of students in 1891–'92 over the preceding year, all the States named except Kansas, Kentucky, Massachusetts, Michigan, New Hampshire, and South Carolina report an increase for the year named, and some of them a still larger increase for the current year. Kansas accounts for a decrease by an increase of requirements for admission, Michigan by a diphtheria scare at the beginning of the year, Massachusetts by a controversy with the Institute of Technology over the Morrill fund. All of them, however, report very satisfactory work and very slight decreases. The South Carolina Agricultural College has not yet opened for work.

In number of graduates all colleges reported an increase except Arizona and Utah, which have not as yet graduated any students, and Illinois, Kansas, Massachusetts, Michigan, New Hampshire, North Dakota, and South Dakota; in some the increase is large, in others very small.

The third question asked for the increase in number of students in agricultural and mechanical courses. In most of the replies the numbers were consolidated so that it is impossible to tell what proportion of the reported increase went to each course. In Illinois, Indiana, and Oregon, where the number in each course is given, the tendency toward the mechanical course is very marked, there being in Illinois a decrease of 11 in agriculture, and an increase of 50 in the other; in Indiana an increase of 15 in agriculture and of 87 in engineering; in Oregon a decrease in the agricultural course and an increase of 20 in the mechanical course. In Kentucky and Nebraska the increase in the two courses is stated as 100 per cent.

Additions to the teaching force and new chairs are as follows: In eleven colleges chairs of mechanic arts, or engineering in some form, have been established, or additional teachers therein provided, namely, in Delaware, Illinois, Iowa, Kentucky, Mississippi, New York, North Dakota, South Dakota, and West Virginia. In addition to these, Delaware, Illinois, North Dakota, South Dakota, and West Virginia have added to their teaching force in agriculture; Kansas, North Dakota, and Oregon in English; and Kentucky, New York, North Dakota, and Tennessee have increased their teaching force in the natural sciences.

Replies to the inquiry as to the organization of new courses of study show that a new course in manual training or in mechanical, civil, mining, or electrical engineering has been established in the following colleges: Delaware, Illinois, Iowa, Kentucky, Mississippi, Missouri, Nebraska, Nevada, Rhode Island, Tennessee, and West Virginia, while existing courses have been enlarged and perfected in Kansas, Michigan, Nebraska, New Hampshire, North Dakota, and Ohio.

Increased facilities in the way of buildings and apparatus show progress all along the line. Probably the best way to indicate what has been done and what is proposed is to state what each college reports in answer to the inquiry on this point.

Arizona reports $8,000 expended in apparatus.

In Delaware a wood-working shop and new recitation hall have been built and $9,000 added in books and apparatus. A new machine shop and foundry will be added during the year.

In Illinois a science building costing $70,000 has been erected and $5,000 expended in apparatus. A new building for engineering is contemplated costing $80,000 to $100,000.

Indiana reports the completion of an engineering laboratory and equipment cost-

ing $50,000, and it is proposed to build an extension to the shops and provide new quarters for chemistry and pharmacy and biology.

In Iowa the new buildings are an annex to the dairy for cheese-making, a new swine house, an office building, a new railway depot, and a new engine room. Additional equipment has been provided in physics, electricity, mechanical engineering, and the stock farm.

Kansas has built an iron shop and foundry, and expended $4,000 in apparatus. Enlarged facilities for instruction and for the library are contemplated.

Kentucky reports a mechanical engineering building and equipment costing $32,000, and equipment in other departments amounting to $5,000.

In Maine there is a new engineering hall costing $30,000, and increase in apparatus in all departments.

In Michigan a new botanical laboratory and greenhouse have been erected, costing 14,500; $6,000 has been expended in books for the library and $10,500 for equipment and apparatus in other departments.

Minnesota has erected a new mechanical shop, with equipments costing $18,000.

In Missouri $50,000 has been expended in buildings.

Nebraska reports a new gymnasium, a new shop and tools for manual training, clay modeling, and drawing. A new library building, to cost $100,000, is in process of erection. Buildings and appliances for the experiment station and departments of agriculture, horticulture, and engineering are contemplated.

New Hampshire is about to remove her college to a new location at Durham, in order to obtain the benefit of a munificent endowment of land and money, amounting to $1,000,000.

New York (Cornell) reports large additions to apparatus and equipment.

North Dakota has erected a $40,000 building and an engine house costing $5,000 and has added to the library and laboratory equipment. In the near future the erection of a dormitory, a chemical laboratory, and farm buildings are contemplated. A geological and library building, a building for mechanic arts, and large additions to apparatus are reported from Ohio. Improvements in the courses in mechanical engineering and agriculture are planned for the future.

Oregon has a new chemical laboratory and a dormitory for one hundred and twenty students and will soon erect a building for a dairy and one for horticulture.

Tennessee reports a new science hall costing $60,000 for laboratories of chemistry, physics, engineering, etc.

South Carolina reports about $150,000 expended in buildings; the college is not yet opened for instruction.

In Utah a new building to cost $80,000 is in process of erection and $20,000 have been expended in apparatus.

In West Virginia a commencement hall and gymnasium costing nearly $20,000 have been completed; a building for mechanic arts and mechanical engineering with equipment has just been opened, costing about $18,000, and a new Science Hall, to cost $40,000, is in process of building. About $5,000 is now being expended for books and $3,000 for equipment in the departments. A new building for electrical engineering is contemplated and $30,000 will be expended in equipment for the various departments.

Summary.

These reports show great activity and enterprise in all the colleges and particularly the stimulating effect of the Morrill act of 1890 in pushing the development of industrial education. What may we not hope for the future of these colleges, when they have become fully equipped and when the annual income provided by this act can be fully devoted to the employment of teachers, thus broadening and deepening the channels of their influence?

I am constrained, however, to call the attention of the convention to one phase of these statistics. Where separate statistics of the numbers in the agricultural and

mechanical courses have been forwarded they show a most unequal advance in the agricultural and mechanical courses. What can be done to stimulate young men who expect to be farmers to take an education that will fit them for the best work on the farm? How can they be induced to come to the colleges and get the elements of an agricultural education in the study of physics, chemistry, botany, zoölogy, and mathematics? It seems to me that this is a problem which we have as yet not properly considered. I leave it for your thought.

E. M. TURNER,
Chairman.

Mr. FAIRCHILD. If I may be allowed to add a word to my report for the Kansas College, it is that we have added several instructors in the mechanical department, one in the horticultural, and several in the agricultural department.

Mr. SANBORN. I would like to add a word to the statement for Utah. The first year we had 139 students, last year 296, and at the present time we have more than 400. Two-thirds of the senior class of next year will graduate in agriculture. The faculty has been very much increased and now numbers 19.

Mr. LEE. The report of President Turner brings out a very important fact, and that is that the colleges are not doing the work for the agricultural classes that they should, and I suppose there is no doubt of the fact that the great industry of agriculture has been languishing. I have been impressed, Mr. President, for several years, with the fact that our colleges are sending forth scientists rather than practical men in the industries which the law intended to benefit. There is no doubt of the fact that comparatively few of the graduates of our colleges return from the colleges to agriculture. All of these institutions that have given statistics bearing upon that point show that only a small per cent go back to the farm. I think the Michigan college claims that about 50 per cent of the graduates return to the farm. The Massachusetts college many years ago used to send a good many men back to the farm, but I do not know whether that is being kept up now or not. As far as we can gather Mississippi has sent back from 40 to 50 per cent to the farm.

I think that this convention can not do better than try to find out what the trouble is and what the proper remedy. There is no doubt of the fact that the law of 1862 intended to benefit agriculture and the mechanic arts only by benefiting the classes engaged in them. I think all these institutions have had the desire to maintain a high standard of admission and graduation. That is right and proper, but I think we have gone a little too far in this matter. I think we ought to get nearer the class to be benefited. We ought to be more in sympathy with them, and I think the standard required of students in agricultural colleges is too high. The farmer's boy can not take advantage of them. The North has better common schools than the South. I will state here that in Mississippi and in the adjoining Southern States it

is almost impossible for a student to come up to the standard required in the freshman class, low as it is in many of the colleges. If the farmer is rich enough to send his son to the high school in town or some training school he may do it. But these institutions are intended to benefit agriculture and the mechanic arts, and if by putting our standard too high we have made a mistake, so that we send hardly any graduates back to the farm, I think we ought to try in this Association to remedy the trouble. We ought to put the diploma within the reach of every country boy. Let him come here and feel that he can get a diploma and that without being a scientist. There must also be a chance for the boy who wants to be a scientist. Let him take a post-graduate course if necessary.

Mr. ALVORD. As this is one of the subjects to come up before the section on college work and perhaps one of the topics which it will present to the Association, I suggest that we take up the report of the next section.

Mr. Ingersoll, chairman of the section on agriculture, presented the following report:

REPORT OF THE SECTION ON AGRICULTURE.

According to the clause in our constitution making it obligatory upon the chairman of a section to present a report at the annual meeting, I beg leave to present the following:

The period sought to be covered in this report dates from September 1, 1891, or soon after the adjournment of the convention of delegates at Washington, D. C.

Because the chairman, as well as other workers, becomes absorbed in the solution of the problems that are more immediately confronting him, and hence in a great measure loses sight of the whole field of action, and further because it was desirable to present the latest as well as earlier data, it was deemed advisable to address each station by circular letter, in order to obtain, if possible, prompt replies with reference to the work of the sections on agriculture proper in each of the experiment stations.

The letter was as follows:

DEAR SIR: As chairman of the section on agriculture of the American Agricultural Colleges and Experiment Stations, the duty devolves upon me to present a report of progress that shall be of a somewhat general character, yet specific enough to be of value in bringing before the section and the Association the full scope of the work undertaken and aggregate results.

To that end you are therefore earnestly requested to answer and return the following questions promptly, and oblige:

(1) What bulletins has your station issued since August 1, 1891, which are entirely or in part the work of your own department? State number and title.

(2) What work in progress not yet reported in bulletins? State by title briefly and, in a word, the degree of progress.

(3) What work has been undertaken or accomplished by collateral departments, as in soil, physics, meteorology, irrigation, engineering, and the like, which will be of interest?

Do not report work that will be reported upon in other organized sections, as chemistry, botany, horticulture, or entomology.

(4) State, in a short letter, your general condition as a station and in your own department, with interesting side statements.

To this communication I received thirty replies from the following stations, and, substantially, in the following order. It will be noticed that several of those farthest away were among the first to reply.

Kentucky.	Georgia.	Kansas.
Mississippi.	Michigan.	Indiana.
Utah.	Connecticut (New Haven).	Vermont.
South Carolina.	Colorado.	North Dakota.
Oklahoma.	Wisconsin.	Tennessee.
North Carolina.	Ohio.	New Jersey.
Wyoming.	Arizona.	New York.
Massachusetts.	Rhode Island.	Alabama (Uniontown).
Connecticut (Storrs).	Virginia.	Minnesota.
Nevada.	Texas.	South Dakota.

No substantial or descriptive reply was given to the four questions by the following stations:

Maine.	New Hampshire.	Pennsylvania.
Delaware.	Maryland.	West Virginia.
Florida.	Louisiana.	Arkansas.
Missouri.	Illinois.	New Mexico.
California.	Oregon.	Washington.

Several persons corresponded, incidentally, on other matters pertaining to the meeting.

In two cases parties addressed were in Europe, and we were notified of the fact, and in one case the director made a very full and complete reply for the person addressed.

After various vicissitudes in attempts at getting reliable information your humble servant and his clerk made an attack on the station files and found that subjects had been treated, in whole or in part, in all the stations as follows:

3 Farm manures.
5 Soils and waters and tests of air and soil relations.
1 Water and water analysis.
24 Fertilizers, weeds as.
3 Glanders.
11 Potatoes, Irish and sweet.
1 Sulphur-curing of fruit.
3 Food investigations.
1 Nitrogenous plant food.
4 Silage and roots.
9 Sugar beets.
4 Blue grass, hay, and timothy.
1 Electroculture.
1 Sorghum.
11 Dairying.
1 Old and new meadows.
2 Detasseling corn.
1 Patent cattle food.
3 Poultry.
1 Tuberculosis.
1 Cotton seed and meal for hogs.
1 Liver flukes.
1 Maple sugar.
2 Seed and plant distribution.
8 Cotton.
1 Canaigre.
2 Irrigation.
5 Tobacco.
21 Corn, wheat, oats, etc.
19 Cattle and sheep feeding.
1 Ramie plant.
6 Forage crops.
4 Milk tests.
2 Rheumatism in horses, and diseases of sheep.
1 Horticulture.
1 Sugar cane.
1 Comparisons of grain.
2 Dehorning cattle.
1 Kerosene emulsion for animals.
1 Inoculation.
6 Dodder, weeds, and rusts.
2 Farm practice with fertilizers to control insects.
2 Organization.
1 Grasses of Tennessee.
1 Corn fodder.
3 Horse-feeding.
2 Veterinary.
3 Insecticides.

When it comes to progress in work in which the stations were engaged, the thirty replies were scanned with care and it was interesting to attempt to group them so as to present them, in part at least, in a condensed form.

The following summary shows the number of stations on the lines of work as stated, or some modification of the work:

3 Sugar beets.
1 Sheep-breeding.
6 Steer-feeding.
1 Analysis of wheat seed in various stages of growth.
2 Cheese.
6 Fertilizer tests with wheat, corn, tobacco, and other crops.
1 Coöperative fertilizer cotton tests.
2 Corn *vs.* fertilizers.
1 Apiary work.
2 Plat tests.
1 Farmyard manure *vs.* fertilizers.
3 Experiments with corn.
1 Value of farm manure.
2 Milk tests for variation.
1 Cañaigre.
2 Irrigation.
5 Dairying.
2 Pig-feeding.
3 Coöperative field tests.
2 Digestibility experiments.
3 Sheep-feeding.
5 Tobacco.
3 Digestibility of peas, silage, corn, bran, barley, shorts.
1 Milled products of wheat.
1 Silage *vs.* dry fodder.
3 Variety tests of cotton.
1 Corn on drained and undrained land.
1 Farmyard manure tests.
1 Poultry work.
7 Variety tests of grain.
4 Green manuring.
2 Detasseling corn.
1 Carbonaceous *vs.* nitrogenous food for chickens.
1 Silage preservation.
1 Sorghum *vs.* alfalfa.
5 Soil physics.
1 Scarlet clover.
1 Horses.
1 Milk separator tests.
3 Feeding for milk, and sugar meal, gluten, meal, etc.
4 Grasses and their management.
3 Cowpeas.
1 Sorghum.
2 Potatoes, Irish and sweet.
1 Pea-vine hay.
1 Plant nutrition.
1 Insecticides.
1 Fertilizer map.
1 Sugar cane and rice.
1 Alkali soil.
1 Corn fodder.
1 Forage plants.
1 Tile drainage.
1 Experiments and continuous cultivation of corn.
2 Cross-fertilization.
1 Botanical survey.
1 Chemistry of cotton plant

The most interesting feature of the reports was the reply, in which, often in a single sentence, would be conveyed more information as to the work, the worker, and the station with which he was connected, than in a long report otherwise made.

Several complained of the lack of funds to perform the work they desired. No blame was attached to any person, only it appeared that too much had been attempted for the funds in hand. In some of the States there are indications of other funds being used to supplement the Hatch fund. This aid comes in part from fertilizer work in some instances.

It is pleasing to notice that the workers in agriculture are working along practical lines and at the same time doing their work more carefully and scientifically as they proceed. The men as a rule are not so hasty in their decisions, and do not reach conclusions at one gigantic bound nearly as often as in the earlier work of the stations. The matter of having tested plats on which to experiment—plats on which the factor of individuality is established or well indicated—is shown in the work of several stations. The removal of the factor of vacant ground next a plat, so that all conditions as far as possible shall be normal, has been followed by others.

In animal-feeding as a rule too many questions have been asked at one time and too much has been attempted in the way of proof. In our opinion but one or two

interrogations should be put to nature at one time; then try and remove all points of variation except the one sought to be proven, and establish that if possible beyond peradventure.

In this work we must make haste slowly or be obliged frequently to "thresh over old straw" or weave a fabric that to the veriest tyro will be like a sieve. Only a few stations feel the necessity of establishing checks in their work when experimenting with animals or of repeating their work for purposes of comparison. We are pleased to see this being done in two or three instances, and look for valuable results from interpretations of such work.

If it is found that under normal conditions and unchanged food we obtain results which vary as much or more than those found under changed relations, then we are simply unable to put an interpretation that is even approximate upon the compared results.

When, therefore, we received a statement that results in one station would be held for a year in order to compare another year's feeding, and that one of the factors in the work was the continuous feeding of one food to note changes in the milk and butter, we were pleased when we read the next sentence:

"The object of feeding the same food for a long period was to ascertain whether the variations between stated periods might not be as great as the variations when different foods were fed." A broad smile of satisfaction attested our approval of the work of that station. Other stations may be doing the same thing, but we are not apprised of the fact. It is our province to speak of that we have seen and know.

Again, it is a pleasure to see the way in which the agriculturists seize upon those things that seem to be an advantage to their States. Thus, the beet-sugar industry engages the attention of States in the northern belt; cane sugar, rice, cotton, and sorghum, those adapted to the culture of these products; tobacco, and the new method of curing, the States extending from Florida to Connecticut which raise this crop, and likewise a few of the Western States; feeding engages attention everywhere, as all States feed for milk and meat, two standard articles of food; forage plants, including grasses, engage the attention of nearly all the States, and alfalfa is a subject of special study in the West; rape is attracting considerable attention; *Lathyrus sylvestris* has done well in my own State, and merits further trial.

Besides the work in the agricultural sections but properly and intimately connected with it is the work of several stations in regard to meteorology, soil physics, irrigation and a few things like cañaigre in Arizona.

The study of the Yucca plant and the like for fiber is necessarily confined to limited areas.

One station says: "The work of our station is mainly practical, very little purely scientific. The station is doing fairly good work and in the midst of prejudice is gradually forcing its claims to recognition as a valuable aid to the farmers." Another says: "A series of farmers' institutes has been commenced and the continual growth of the mailing list indicates a gratifying interest in the work of the station on the part of the farmers of the State." And what seems to us to be more important than all the facts announced is that there have been no changes in the station force during the year.

Another writes that "the agricultural department has been very successful in the experiments of the year." The students and farmers are becoming more interested. A second edition of one bulletin was called for and the third will soon be issued, with an appendix.

Another says: "The field work has been of long-continued permanence and grows more and more valuable and more and more appreciated by the farmers from year to year. No attempt is made to elaborate, but rather to concentrate and do limited lines of investigation well. The funds of the station permit the employment of intelligent assistants, and the most improved utensils are employed in the work. The development of the agricultural department is satisfactory and the many visitors to the station find this of great interest."

Another says: "The station has a compact organization, everything convenient, and the work economically conducted. In a general way it embraces the field of biology, dairying, animal nutrition, plant nutrition, chemistry, horticulture, entomology, soil physics, and general experiments in plant growth, including tillage."

Another says: "The work of our station is more particularly in the line of dairy work, and we feel fairly well satisfied with its conditions and especially with the relations we have succeeded in establishing with the dairymen of the State. Our connection with them becomes more and more intimate each year, and especially in the matter of testing milk and of paying for milk at creameries and cheese factories by tests. We have reason to believe that our work has been of a good deal of value to them, if we do say it."

Another says: "All the appliances about the college and station, including stock, dairy, vineyards, etc., are used as a laboratory for the students in agriculture in its broadest sense as an 'applied science.'" The amount of foundation work in this station and one other, both new, has been enormous and merits especial mention. In another State students are sent out in charge of special work at substations established. The writer says: "A student put in charge of work thoroughly planned and frequently inspected beats other forms of substation management."

Seed distributions have been made in three or four of the more Western stations where the conditions seem to demand it and are favorable for a just appreciation of its worth.

Coöperation is urged by another, who says: "Not that all can agree, but that small groups of workers could be formed where the conditions were favorable to work on special agreed lines.

"This station is desirous of coöperating and I believe we are ready to coöperate with some others in dairy work and pig-feeding."

Another says: "We are endeavoring here to do such work as will promote the agricultural interests of our own State and at the same time contribute as much as possible to the advance of genuine scientific investigation," and another speaks of poor soil, much depleted by long cropping, and of the one great problem of how to bring it up and use better animal husbandry with diversified products. He says: "We have had no disaster from moving, fire, or flood." Several others have met one or more of these to their sorrow and temporary disadvantage.

Another says that the work is being appreciated more each year by the farmers. Five bulletins a year are issued. In another instance the general condition of the station is good. Experiments are carried on at six substations or experiment farms, five conducted with and one without irrigation. The superintendent of each farm is controlled by directions sent out from the head of each department of the university. Plans for experiments at all the farms are recommended to the experiment station committee of the board of trustees by the station council. This plan insures uniformity of plan and purpose at all substations and is considered advantageous. Efforts are to be made to establish experiments in stock-breeding, feeding, dairying, etc., at each farm, because of the prominence of stock-raising as an industry.

Another says: "The station force is extremely active and we have on hand much more material than we can publish on account of limited funds. The field covered by the station has become extremely extended and yet we see many problems which need to be investigated. The testing of varieties and field experiments have not so far yielded such wide results as have those which have been conducted in buildings where the conditions could be better controlled than in the field." We agree very fully with this writer and know that experiments of the latter class are more interesting to the worker and will give more positive results; yet if time is taken and the proper checks maintained, and further, if the factor of "individuality" or "personal equation" for each plat be properly looked after and as far as possible eliminated, then we may obtain much satisfaction from plat experiments.

In closing this dissertation I wish to thank those who have responded so promptly

to my request for information which for lack of time has been loosely thrown into groups. The tardy ones caused some delay in commencing the work. Perhaps they were too busy to stop experiments long enough to reply but are here and will give us in person what they have failed to send.

C. L. INGERSOLL,
Chairman.

The PRESIDENT. If there is no objection the report will be filed with the secretary. Next is the report from the section on botany.

Mr. TRACY. Prof. Atkinson, the chairman, owing to his duties at Cornell, where he has gone recently, is not present, and has asked me to read his paper.

Mr. Tracy then read the report of Mr. Atkinson as chairman of the section on botany, as follows:

REPORT OF THE SECTION ON BOTANY.

Since the last annual report was presented from the section on botany before this Association the force of botanical workers in the experiment stations has been increased by the organization of departments at the following stations: Arizona, Florida, New Mexico, South Dakota, and Texas, the officer at the latter station being horticulturist in charge of botany.

Several changes have been made in the working force. At the Alabama College Station, G. F. Atkinson retired October 1, 1892. At the Kansas Station, A. S. Hitchcock was appointed January, 1892, to succeed W. A. Kellerman. In Massachusetts, J. E. Humphrey retires January 1, 1893. In Michigan the station work has been reorganized, and C. F. Wheeler appointed botanist. At the New York Cornell University Experiment Station, W. R. Dudley retires to accept a position in Leland Stanford University, and G. F. Atkinson, of Alabama, has been appointed cryptogamic botanist.

At several stations where botanical work is carried on there is no regularly appointed botanist, that work being in charge of the horticulturist or entomologist. Since botanical work has come to my notice from several of these places it has seemed best to include it in the report. In view of this and the fact that several of the botanists have charge also of entomology or horticulture, or are given the titles mycologist or biologist, the official title is placed in parenthesis accompanying each station's work.

Alabama: P. H. Mell (botanist and meteorologist, has charge of phanerogamic botany) is engaged upon a study of the economic grasses and weeds of the State, and is crossing varieties of cotton. Mr. Atkinson (biologist, has charge of plant pathology) has continued his studies of cotton diseases, has discovered a new damping-off fungus, obtained pure cultures of Pammel's ozonium of root rot of cotton in Texas, and is studying the biology of the organisms which cause leguminous root tubercles.*

Arizona: J. W. Toumey is making observations on the adaptability of the native grasses, trees, and shrubs for cultivation.

Connecticut (New Haven): W. C. Sturgis is studying the diseases of tobacco and making experiments in curing tobacco and spraying fruits and garden crops. He is beginning a critical study of the Cribrariaceæ.

Delaware: F. D. Chester (mycologist) is engaged upon studies of Monilia fructigena; diseases of watermelons, muskmelons, and cucumbers, and the winter killing of blackberries. He has reached promising results in treatment of peach rot.

Florida: P. H. Rolfs (botanist and entomologist) has recently entered upon his duties.

* For continuation see Cornell University Experiment Station in this report.

Illinois: T. J. Burrill (botanist and horticulturist) is studying bacterial diseases of plants, raspberry rust, monilia of plum, and economic smuts.

Indiana: J. C. Arthur (botanist) is investigating the normal growth of the potato, and the relation of the number of eyes of a tuber or part of a tuber to the number of stocks produced and to the yield. He is also studying the enzyme in seeds of wheat and oats, the relation of green seed to early maturity, and wheat smuts, and has devised a method of preventing the rust and bacterial disease of carnations.

Iowa: L. H. Pammel (botanist) is studying the life history of *Peziza sclerotiorum*, *Rhizoctonia betæ*, and *Cercospora beticola*. He has experimented on the effect of fungicides upon roots and germination of seeds, crossing of cucurbits, treatment of plant diseases, and is at work on the chromogerm bacteria of the Ames flora, and anatomy of cucurbits.

Kansas: A. S. Hitchcock (botanist) is experimenting with fungicides on seeds and studying the biology of weeds, and economic Uredineæ.

Kentucky: H. Garman (entomologist and botanist) is engaged upon comparative study of foreign plants.

Maine: F. L. Harvey (botanist and entomologist) is making collections of economic plants.

Massachusetts: J. E. Humphrey (vegetable physiologist) has been studying black knot of plum, a violet disease, and a new disease of cucumbers, and is preparing a monograph of North American Saprolegniaceæ.

Michigan: C. F. Wheeler is consulting botanist.

Mississippi: S. M. Tracy (director of station) is making a botanical survey of the State and working on the Gramineæ, Southern tomato blight, and a new disease of the grape.

Nebraska: C. E. Bessey (botanist) is making an exhaustive study of native trees and shrubs, and native and cultivated grasses, and is at work on diseases of the sugar beet.

New Jersey: B. D. Halsted (botanist and horticulturist) is working on diseases of the cranberry, rose, violet, and hazel, and fungi of weeds, and experimenting on treatment of celery and sweet potato diseases.

New York *(*Cornell*):* G. F. Atkinson (cryptogamic botanist) is engaged upon a study of winter blight of tomatoes, a botrytis disease of beans, carnation diseases, and damping-off fungi.

New York (*Geneva*)*:* S. A. Beach (horticulturist) is studying the effect of copper compounds in soil on vegetation. He has obtained good results from Bordeaux mixture and selection of seed for anthracnose of beans, and from Bordeaux mixture for Septoria on chrysanthemums. He has also treated apple and potato scab, raspberry anthracnose, gooseberry mildew, strawberry leaf-blight, and celery diseases. He has, in coöperation with D. G. Fairchild, experimented on the effect of rainfall on pollination.

New Mexico: E. O. Wooten (botanist) is collecting plants for a herbarium.

North Carolina: G. McCarthy (botanist) does entomological work, is engaged in seed-testing and treatment of grape and tomato diseases, and is studying bacteria of nitrification.

North Dakota: H. L. Bolley (botanist) has found corrosive sublimate effective in preventing potato scab; is studying the fungus of deep scab of potatoes, making attempts at artificial cultures of Uredineæ, and working on the distribution of root tubercles of the Leguminoseæ.

Ohio: Miss F. Detmers (botanist) is collecting the rusts (Uredincæ) of the State.

Oregon: M. Craig (botanist) is at work on weeds, forage plants, and plant diseases.

Pennsylvania: W. A. Buckhout (botanist) does entomological work, is engaged in

---

*The botanical department has charge of the experiment station work in botany, which is intrusted to the cryptogamic botanist.

forestry and hybridization, and is working on the practical side of potato rot and downy mildew of the grape.

Rhode Island: L. F. Kinney, (horticulturist and acting botanist) has reached important results in the treatment of seed potatoes with Bordeaux mixture to prevent potato scab. He is also treating seeds.

South Dakota: T. A. Williams (botanist) is making observations on forage plants suited to varying conditions in different parts of the State and studying plum pockets and a geranium disease.

Tennessee: F. Lamson Scribner (director and botanist) has published a list of the grasses of the State in the form of a popular edition, to be followed by a more technical one.

Texas: R. H. Price (horticulturist) does entomological work and is engaged in treatment of cotton and grape diseases.

Utah: The entomologist acts as consulting botanist.

Virginia: E. A. Smyth, jr., has charge of phanerogamic botany. W. B. Alwood (horticulturist) is engaged in studying apple-leaf diseases and experimenting on weak solutions of copper salts for plant diseases.

Vermont: L. R. Jones (botanist) has made a test of the comparative value of a number of the standard fungicides on potato rot (*Phytophothora infestans*).

Wisconsin: E. S. Goff (horticulturist) is working on apple scab and experimenting on the germination of seeds.

In looking over the work of the station botanists it is interesting to note the number who are engaged in making use of artificial cultures in studying the life histories of parasitic fungi. Not only are the stations through this work constantly making important contributions to the biology of many obscure and little-known organisms, but they are making known many facts which have an important bearing on the treatment of the diseases produced by these parasites. The different habits and appearances of the real enemy are brought to light; its plans of attack are studied; proof of its harmfulness can be established by inoculation, and known causes thus supplant supposed ones. No other feature of botanical work at the experiment stations, in my estimation, is doing so much to lay the permanent foundations for a rational economy in the treatment of plant diseases.

The best work of this kind can only be successfully carried out with the aid of expensive modern apparatus appertaining to bacteriological laboratories. This provides the trained workmen with the means of proceeding rationally and accurately to the desired end. The stations which at the present writing are provided with such cultural apparatus are the following:

Alabama, Connecticut (New Haven), Delaware, Illinois, Indiana, Iowa, Kansas, Kentucky, Massachusetts (Amherst), New Jersey, New York (Cornell), New York (Geneva), North Carolina, North Dakota.

Several workers in other stations feel the need of cultural apparatus in their work. It is hoped that another year will find them provided with this want.

Steps were taken to determine the number of volumes in station libraries relating to botany, accessible to the workers. Sufficient data were not received to incorporate anything more than a general statement in this report to the effect that several of the stations, even those remote from the larger seats of learning, are building up surprisingly large and valuable libraries and herbaria.

Respectfully submitted.

GEORGE F. ATKINSON,
Chairman.

The PRESIDENT. If there is no objection the report will be filed with the secretary. Next is the report from the section on chemistry.

Mr. Scovell, chairman of the section on chemistry, presented the following report:

Early in September a circular letter was addressed to the chemists of the agricultural colleges and experiment stations, asking for a brief report of the chemical work completed or under way since the last meeting of this Association. To this letter twenty-three replies were received. It is evident from these replies that the chemists, taken as a body, are considering many subjects covering the field, from mere detective work to purely scientific investigations. Some forty different subjects are reported as having been considered. I would trespass beyond my allotted time were I to consider these various subjects separately, or even give the brief synopses of the reports received, which I have had compiled, and which are appended to this report.

Like my predecessor, I have endeavored to classify the various subjects considered, and for this purpose have adopted in the main his admirable scheme of classification. I have classified the subjects, therefore, under the following principal heads: (1) Detective duty; (2) work directly related to farm management; (3) work having in view the improvement of processes or the development of agricultural manufactures; (4) work of a more strictly scientific nature. Most of the work reported falls under one or more of these classes. It is not always easy, however, to tell under which one some of the work should come, as some reporters give the mere facts without giving the purposes of the work. Take, for instance, the analysis of feeding-stuffs. A number report having made such analyses, without stating whether it was for the purpose of giving the farmers information as to the purity or whether it was done in connection with feeding-experiments. Again, soil analysis might be mere routine work, or it might be an exhaustive investigation which more probably would come under scientific investigations. In the main, however, the reporters have not only outlined the work, but have explained sufficiently to readily classify it.

(1) *Detective duty.*—Detective duty or routine work undertaken to protect the farmer against fraudulent practices in the business world. Under this class is placed the routine work of fertilizer analysis when made for the purpose of verifying for farmers the statements of dealers, or for the discovery or prevention of fraud, either with or without fertilizer control; also the examination of feeding stuffs, dairy products, and other materials for adulteration.

(*a*) Fertilizer analyses: Eleven stations report work under fertilizer analyses, eight assuming fertilizer control. It is evident, however, that some of the stations reporting did not incorporate fertilizer control work, assuming, undoubtedly, that such work was not a matter of consideration here, as the funds for such work come from the State or from fees. [The analysis of fertilizers to detect fraudulent practice seems to be generally undertaken by those stations which are in the fertilizer belt.] None of the stations report that the fertilizer work prevents more important and at least more interesting work being done. One station distinctly states that the fertilizer control work is a source of revenue which materially aids it in other work.

(*b*) Feeding stuffs: But one station reports the analysis of feeding stuffs with the object in view of detecting adulterations.

(*c*) Adulterations of dairy products: Two stations report that they are doing work for dairy commissioners in the analyses of butter, etc.

(*d*) Detection of poison: One station reports a case of poison maliciously given to cows.

(2) *Work directly related to farm management.*—This includes a large amount of chemical work carried on for the purpose of determining or practically demonstrating for the farmer the best methods of carrying out farm operations, including such work as soil tests of fertilizers, feeding stuffs, the test of milch cows and dairy breeds, the preservation of manures, utilization of waste products, etc. All the chemists replying report work under this head as follows:

(*a*) Soil tests with fertilizers: Seven stations have been devoting some of their time to the chemical work in soil tests with the commercial fertilizers.

(*b*) Feeding experiments: Four stations report work in feeding experiments.

(*c*) Composition of plants: Thirteen stations are at work on the analyses of plants. Some of them are doing far more than the mere routine analyses. They are studying individual plants. When such is the case they are also given credit for work under the fourth general class.

(*d*) Analyses of plants at different stages of growth has occupied the attention of four chemists reporting.

(*e*) Analyses of newly introduced plants: The analyses of plants newly introduced when considered locally has been undertaken by four chemists.

(*f*) Test of milch cows and dairy breeds: Eight stations have had this topic under consideration. Some are at work making a comparative test of dairy breeds, others are analyzing the milk of individual cows for the purpose of studying the composition in relation to feeding experiments or for an object lesson to the farmer, showing him the necessity of weeding out the cows in the dairy which do not pay for their keeping.

(*g*) Analyses of manures, waste products, etc.: Eleven stations are giving their attention to the analysis of manures, waste products, etc., some of them devoting considerable attention to this, both as a matter of illustration and for the purpose of determining to what extent the waste materials on the farm and in the factories can be utilized in restoring the fertility of our soils.

(*h*) Soil and water analyses: Twelve stations are at work on the analysis of soils or waters, or both. Some few of the stations are giving a great deal of attention to this topic, and alkali soils and irrigation waters have been very generally considered by our Western stations.

(3) *Work having in view the improvement of processes or the development of agricultural manufactures.*—Under this class may properly come much of the chemical work in our creameries and sugarhouses, and also the study of the sugar beet, sorghum, and cane as to their content, the object being to develop an industry.

(*a*) Test of plants for sugar: Nine of our stations have been studying the sugar beet or the sorghum plant, some stations giving considerable attention to the sugar beet.

(*b*) Dairy problems: Seven stations report work under this topic. It is impossible in some instances to tell whether the work properly comes under this class or under detective duty, as the analysis of milk for creameries, etc. Some few of the stations are entering extensively into the chemical problems involved.

(*c*) Milling: One station reports a study of milling products.

(4) *Work of a more strictly scientific nature.*—Under this head may be placed the comparative study of soils, plants, and foods; analyses for the purpose of studying plant physiology and nutrition; digestion experiments; a study of the food of man; and studies of chemical methods and apparatus, the object being the improvement of methods for the sake of accuracy, saving of time and convenience, or for the development of methods and invention of apparatus in original investigations. At least three stations are taking up the soil question. Three stations are studying the tobacco plant and as many are at work on the cotton plant. The loss of nitrogen in the development of plants has been considered by one station. A number of stations are at work in or arranging to undertake digestion experiments. Thirteen of the stations reporting have been to a greater or less extent studying chemical methods and apparatus.

From the reports it is to be clearly seen that while the chemical work of our sta- is to a great extent has been, and probably will continue to be, of a routine nature, value of which should not be underestimated, nevertheless considerable work of gher nature is being undertaken or contemplated in the near future. The thor- h equipment of many of our stations and the additional force being employed es an opportunity for a more thorough and systematic study of chemical problems.

The time and attention given to chemical methods by nearly all our stations, as evinced by the work reported to the Association of Official Agricultural Chemists, is indicative of progress. When we consider that nearly all of our stations have been organized in the past few years, that many of our workers were necessarily inexperienced in practical work, we can but wonder at the work accomplished and the accuracy of the results obtained. I feel it but justice to say that much of this credit is due to the Association of Official Agricultural Chemists. The uniformity of methods—methods tried by the crucial tests of experience, a great saving of time by the use of such methods, the shortening of the work of our chemical engineers by tunneling through rather than going around obstacles—have enabled our stations to do much thorough, accurate, and comparable work, which never could have had the value it has save for the training and assistance our chemists have had in and by our Association of Official Agricultural Chemists.

ABSTRACTS OF REPORTS FROM STATION CHEMISTS TO THE CHEMICAL SECTION.

C. B. Collingwood, of the Arizona Station, reports that their chemical work has been (1) a study of the character of water used for irrigation and its effect on the soil and on plant growth; (2) the character of the soluble material in the soil and the effect which water will have on it; (3) best methods of curing alkali soils; (4) investigations as to the per cent of tannin in cañaigre. Canaigre is a Rumex indigenous to the arid region, which contains in the green root about 10 per cent of tannin. By cultivation for one year it is found that the same amount or sometimes more tannic acid will be formed. So far the chemical work of the station has been along the line of analysis of waters, soils, and native plants, which may become of economical importance.

G. L. Teller, of the Arkansas Station, summarizes their work as follows: (1) The study of methods of analysis in connection with the Association of Official Agricultural Chemists; (2) a study of the loss of nitrogen during the growth of certain plants; (3) the study of the composition of the cowpea in the different stages of its development; (4) compilation of other experiments in agricultural chemistry, published in Bulletin No. 19.

D. O'Brine, of the Colorado Station, reports work in the following lines: (1) Manure; (2) the loco question; (3) milk, sugar-beet, and soil analyses.

E. H. Jenkins, of the Connecticut State Station, reports of the chemical work of the station, aside from the routine of fertilizer control, fodder analyses, milk tests, and the assistance rendered to creameries in introducing a system of milk-testing: "We have studied somewhat methods of cheese analysis. Our chief work, perhaps, has been the inauguration of experiments designed to extend over a term of years to test the effect of fertilizers on the quantity and especially the quality of the Connecticut wrapper leaf tobacco, the final judgment of quality to be made after the leaf has gone through the fermentation and is ready for the cigar manufacturer."

Mr. C. D. Woods, of the Connecticut Storrs Station, reports that the principal chemical work of the station during the last year has been: (1) Routine analysis in connection with the study of the food of man; (2) feeding experiments with animals; (3) the analysis of crops grown in field experiments.

E. H. Farrington, of the Illinois Station, says: "The chemical work of this station for the past year has been mostly on the analysis of milk, sugar beets, soil, and feeding stuffs. I am making some investigations of Grandeau's method of estimating *matière noire* in soils; also observations on the soil moisture in the first 6 inches of corn land throughout the season." Dr. Farrington reports that he is c[illegible] Frat-
siderable work under the topic of developing analytical methods, especia[illegible] tion
ing stuffs and the use of improved apparatus. He is using a 1-horse p[illegible] thods,
trical motor for running a Babcock milk-tester; also an automatic [illegible] a hists
measuring the acid in milk-testing, and reports that it has proved to l[illegible] oug
practical when properly constructed. giv

H. A. Huston, of the Indiana Station, reports that they have been engaged upon work with phosphoric acid and sulphate of alumina on corn, field experiments on the forms of nitrogen for wheat, improvement of the so-called bogus soils—both field and laboratory work—rate of souring milk under different conditions of setting and examination of butters produced, feeding and fertilizer value of pursaline, the study of chemical methods, and other miscellaneous matters.

G. E. Patrick, of the Iowa Station, reports for the chemical work of his station as follows: (1) Effect of feed upon quality of milk; (2) sugar beets in Iowa; (3) sweet *vs.* sour cream butter; (4) chemical work in calf-feeding experiments; (5) soiling experiments; (6) feeding beets and potatoes for butter; (7) soil analyses.

In the chemical laboratory of the Kentucky Station work has been carried on in the following lines: (1) Daily tests of milk in connection with a feeding experiment for butter fat as well as for comparing the milk of different cows, analysis of butter in connection with the above experiment, analysis of feeding stuffs in connection with the above feeding experiment and also for farmers; (2) tests of sugar or varieties of cane grown at the station; (3) analysis of potable and mineral waters, marls, and soils; (4) examination of miscellaneous materials sent in by farmers and others; (5) examination for poison in viscera of a number of cattle (the results of this work aided in the conviction of one person for cattle poisoning); (6) determination of specific gravity of all the varieties of potatoes raised at the farm, with a few determinations of dry matter in the same; (7) work on methods of analysis in connection with the Association of Official Agricultural Chemists, and analysis of a number of honeys; (8) the whole of the work of the State fertilizer control, besides the analyses of several grasses grown at the station, is now in progress.

H. J. Patterson, of the Maryland Station, reports that the work of the chemical department has been chiefly with the tobacco plant on (1) the effect of fertilizers on the composition of the ash and burning qualities; (2) the effect of different methods of curing on the organic constituents; (3) fodder work in connection with the feeding and digestion experiments; (4) analyses of marls, limestones, and fertilizers used in experiments.

C. A. Goessmann, of the Massachusetts State Station, reports that the lines of chemical work have been (1) analysis of licensed fertilizers; (2) analysis of commercial fertilizers or manurial substances; (3) analysis of agricultural chemicals, a refuse material used for fertilizing purposes; (4) analysis of fodder articles; (5) analysis of water; (6) analysis of butter and butter-fat substances for the Massachusetts State dairy bureau; (7) investigations on the effect of the application of different fertilizers on the condition of plants.

H. Snyder, of the Minnesota Station, reports that work in the chemical laboratory of the station has been under the following lines: (1) in dairying, the manufacture of cheese from milks rich and poor in fats, the incorporation of cream into cheese, losses in cheese-making, artificial curing of cheese, and the development of acid in cheese-making. (2) Digestive experiments with milch cows—pea silage and wheat bran; with pigs—barley, barley and shorts, corn, corn and shorts, bran, peas, etc. In these latter experiments complete analysis has been made of the food and in the case of the cows the milk also. (3) Analysis of the beets grown by farmers in the different parts of the State, and tests of varieties of beets and sorghum. (4) The composition of the wheat plant in its different stages of growth, and the analysis of different grains of wheat and all the milled products from the same. (5) Analysis of the main fodder and grain crops of the State. (6) Soil collection and analyses. (7) Analysis of water and milk samples sent by farmers, and other miscellaneous work.

W. L. Hutchinson, of the Mississippi Station, reports that the chemical work for the station during the past year has been on grasses, marls, water, cotton plants, and milk.

F. W. Morse, of the New Hampshire Station, reports that the work pursued in the

chemical laboratory of the station has been (1) a study of the effect of feeding upon the composition of butter fat; (2) investigation of maple sap, sirup, and sugar with reference to the season; (3) composition of fodder corn with reference to the amount of seed per acre and the investigation of nitrogen-free extract in the same; (4) development of analytical methods.

New Jersey has been at work on (1) analyses of commercial fertilizers. (2) Analysis of fertilizing materials, manures, waste products, etc., (*a*) for the purpose of giving exact information as to their character and composition; (*b*) to indicate economical methods of buying and using. (3) Analyses of farm crops, (*a*) to determine the character and value of newly introduced plants; (*b*) to determine the effect upon the composition of potatoes and sweet potatoes, of the use of different kinds, forms, and qualities of plants and qualities of plant food. (4) The study of chemical methods. We have tried the Gunning method for the determination of nitrogen both in the presence and absence of nitrates; the Ulsch for nitrogen and nitrates; modifications of the official method for the determination of potash; and the drying of fats in air and hydrogen after extracting according to the official method.

A. Goss, of the New Mexico Station, reports that the chair of chemistry of the New Mexico College of Agriculture and position of chemist to the station have only lately been created, and he has no work to report.

H. B. Battle, of the North Carolina Station, gives the following synopsis of the chemical work done by the station: (1) Analysis of commercial fertilizers; (2) investigations in connection with the analysis of cotton seed and cotton-seed meal; (3) analysis of marls and limestones—work in connection with the development of analytical methods for the Association of Official Agricultural Chemists; (4) identification of ores, minerals, etc.; (5) iron ores; (6) mineral waters; (7) investigations with tobacco with reference to composition; (8) study of the composition of native and wild grasses and various feeding stuffs; (9) digestion experiments; (10) study of sorghum as to its sugar content.

G. L. Holter, of the Oklahoma Station, reports that the station has just been organized and that he has no work to report.

G. W. Shaw, of the Oregon Station, reports that the Oregon Station has been confined to two lines: (1) Work on the sugar beet; (2) an investigation of the Oregon soils.

H. J. Wheeler, of the Rhode Island Station, reports that the chemical work of his station during the year embraces the analyses of commercial fertilizers, factory refuse of agricultural value, fodders, well and spring waters, and a systematic analysis of the algæ which appears on the Rhode Island coast, with special reference to their fertilizing qualities.

M. B. Hardin, of the South Carolina Station, reports the chemical work of the Clemson Agricultural College as being confined to (1) the analyses of feeding stuffs, sugar beets and fertilizers; (2) an examination into the character of phosphoric acid in cotton-seed meal and the ratio of available to the total phosphoric acid, and of the water soluble to the total potash in such meal. Analyses of official samples of commercial fertilizers have also been made at the South Carolina station.

C. W. Dabney, of the Tennessee Station, reports the chemical work done by the station: "We have completed and published a bulletin on the cotton plant. This is a chemical study of the cotton plant and all its parts and all the products of the cotton-seed industry. We have also analyzed a number of feeding stuffs, samples of milk, butter, etc. Most of our time work has been given to a systematic study of the soils of Tennessee. The soils of East Tennessee have been completed, and we are now at work upon the soils of other sections of the State. The station also makes the analyses for the State bureau of agriculture in connection with the fertilizer control."

H. H. Harrington, of the Texas Station, reports the study of grasses and forage crops. The soils of the State have been given attention by this station and they are just beginning to study animal foods under special conditions.

J. L. Hills, of the Vermont Station, reports that the work of the chemical department is largely in connection with the dairy, and has covered about three thousand analytical samples of dairy products; also with the manufacture of maple sugar and sirups, and fertilizer control; together with fodder analyses in connection with feeding experiments, and the study of analytical methods.

R. J. Davidson, of the Virginia Station, reports the analysis of feeding stuffs, fertilizers, and marls, and a special chemical study of the tobacco plant.

E. E. Slosson, of the Wyoming Station, reports that the chemical work of the station has been on the following lines: (1) analysis of sugar beets; (2) analysis of soils; (3) analysis of mineral waters of the State; (4) analysis of native and cultivated grasses.

M. A. Scovell,
Chairman.

The President. If there is no objection the report will be filed with the secretary. Next is the report of the section on entomology.

Mr. Osborn. Prof. Bruner is not present but has sent me his report, with the request that I present it to the association. It is as follows:

Report of the Section on Entomology.

While there is still a certain amount of ridicule entertained for the "bug catcher" or entomologist, this feeling of apparent disgust on the part of the general public for himself and his "pets" is rapidly disappearing. Consequently it has even been acknowledged, in a quiet sort of way, that some of these misguided mortals are harmless fellows. It has also been asserted on one or two occasions that they are not "bad;" when everything is taken into consideration, they do not differ very much from other people. But—well, no matter.

There has been no great change in the personnel of the entomological workers in the stations and colleges during the past year; hence it has been thought best not to repeat the report of a year ago and that of two years ago. We have had reports on the work being done by different members of the society of station and college economic entomologists from year to year. This year, therefore, I thought it might be well to digress a little from the custom of the past and report on the equipment of the various institutions for this work. I accordingly sent out personal letters to all of the working entomologists of the society, asking for concise statements respecting the equipment of the departments under their respective charge. These letters were replied to by a number of the entomologists addressed, but others have thus far paid no attention to them.

Judging from the reports received, the different institutions in the East are apparently much better equipped for entomological work, both as to reference libraries and apparatus with which to work, than are those in the West. They are also provided with more and better room than we in the western part of the country can boast of. This, when we take into consideration the fact that the East also contains most of the large reference libraries of the country, does not speak well for the institutions of the West. True, there are extenuating circumstances which should be taken into consideration before we criticise too severely. The Eastern States have been settled much longer and are more thickly populated. The insect pests have also had more time to increase and become spread over that region than they have had in the West. On the other hand we in the new West transact our agricultural business on a much larger scale than do our Eastern friends. Our insect pests, while perhaps fewer in number of species, are greater in number of individuals of each species. These must be handled over hundreds of acres, whereas in the East they are dealt with on only a few acres.

Of the thirty-odd workers the country over, it will be seen from a perusal of the following reports that a number of them are provided with special buildings or

insectaries, with greenhouse attachments, in which to carry on their investigations. Others of our number are without these aids. Some are supplied with ample means for both field and laboratory experimentation against the insect pests of their respective localities, while others have hardly anything in the shape of these aids, and scarcely more than the bare space in one corner of a small room with which to attack the host of insect enemies which they are supposed to control.

As would naturally be supposed, the workers who are best equipped and at the same time well supported by the governing boards of their respective institutions, have been and are now doing the best work. Economic entomology does not mean the mere gathering and pinning away in boxes of a number of miscellaneous insects, as many people seem to think, nor do any of the workers who have been engaged to fill these positions wish to make such their trust.

What we need as workers who are expected to accomplish much in economic entomology, is the following equipment: (1) Good and ample room to work in; (2) first-class reference libraries and collections of typical specimens, along with sufficient apparatus in the shape of breeding cages, jars, microscopes, cameras, drawing tools, materials, etc.; (3) machinery for the application of insecticides in laboratory and field; (4) sufficient appropriations to enable us to carry on our experimental work with insecticides and other methods of insect control on a sufficiently broad scale to insure success. Without support of this kind it is wrong to expect the workers in economic entomology to accomplish great results. Give us an opportunity to prevent the great annual losses sustained by the agricultural and other interests of the country from the ravages of depredating insects, and we will do our utmost to meet this demand.

Standing at the head of the economic entomological work of the country is the Division of Entomology of the U. S. Department of Agriculture. This is in charge of Prof. C. V. Riley. Without this branch of government work to fall back on the various workers in the stations and colleges would be much hampered in their researches in economic entomology. Assisted as he is by so many special workers, Prof. Riley has been able to make the Division a vast storehouse of information on the life histories and habits of most of our indigenous insects. With the good reference libraries and collections at hand any doubtful question that may come up in the several stations of the country can be quickly settled in Washington. It is the Mecca to which all entomologists of the country journey. Recently the building of a typical insectary for use in connection with this Division of the U. S. Department of Agriculture has added to its usefulness. Not only are there a number of workers located in the rooms of the Division at Washington, but there are also a number of field agents distributed over the country, where they are occupied in making special investigations on the insects in the regions where they are located. The equipment of this Division is nearly perfect. No report has been received.

The following reports from the institutions heard from will indicate about the condition of equipment of the various institutions of the country that are more or less engaged in the study of economic entomology:

Alabama, although not having a special entomologist, carries on this line of work in the Alabama Polytechnic Institute. The work here is in charge of Prof. Geo. F. Atkinson, the professor of biology. He reports as follows: "With all this work on hand (pathological and mycological), I can at present do little in entomology, and the comparatively small equipment for insect study would not be worth mentioning." The professor, however, states that his institution is very well equipped for bacteriological and mycological work, his library and collections in that direction being very good. He also states that he has a special hothouse for the study of fungi, etc.

From Arizona J. W. Tonmey reports that "the department of entomology at this station has been in operation less than a year. As yet the library is poorly supplied with necessary reference books on the subject; however, we hope to make considerable

additions in this line in the near future. We have a reference collection of nearly two thousand specimens, many illustrating species of economic importance. The university being located in a non-agricultural region, but few field experiments have been carried on; however, during the summer I will spend two or three weeks at Phœnix in the special study of the injurious insects of that region. We are well supplied with necessary machinery for the application of insecticides. We have been especially investigating the insects injurious to canaigre (*Rumex hymenosepalus*), a plant the economic importance of which we are investigating as to its value as a source for the supply of tannin."

In Arkansas there is no separate department for the purpose of investigations in economic entomology, although there is engaged at the Arkansas Industrial University a professor, J. F. McNeill, who is an entomologist.

California is well equipped for work in this line, and not only has an experiment station entomologist, C. W. Woodworth, but also a professor of entomology in the College of Agriculture. There are, in addition to these, two special agents of the U. S. Department of Agriculture located in the State. The San Francisco Academy of Sciences is provided with a good reference library, to which the entomologists have access.

The State of Colorado has an entomologist, C. P. Gillett, who is connected with both the experiment station and the agricultural college. He is provided with an assistant. His report reads as follows:

"For apiary experiments there has been erected a good honey house, with storage and work rooms and cellar. I have thirteen colonies of bees and an abundance of furniture and tools to work with in the apiary. The insect collection probably numbers not less than 10,000 specimens, all of which have been taken in the past year and a half, and the number is rapidly growing. We are putting special stress on collecting and rearing insects this year. Our breeding-cage numbers for this year have reached 261 to date, (July 28). I keep an accessions and a species catalogue and a breeding-cage record, with a system of cross references, and as full data as possible are kept of everything that enters the collection. To contain the collection I have 112 Harvard boxes, 75 Schmitt boxes, and 25 other boxes for which I know no name. The section is also fairly well equipped with the various insecticides and pumps and other apparatus for applying the same. I am allowed one good assistant, who devotes most of his time to station work. The station has use of the microscopes, photographic apparatus, etc., belonging to the college."

Connecticut does not report any special work in this line.

M. H. Beckwith, of Delaware, reports that the entomological work of this station is carried on in connection with the horticultural work, and in consequence of not having an assistant the time has to be divided between the two departments, often to the detriment of one or the other of the lines of work.

"The library contains about one hundred and fifty volumes, principally on economic entomology. We have no reference collection except such as I have been able to secure in connection with my routine work. The facilities for breeding and studying life histories are a glass house and breeding cages similar to those illustrated by Dr. Riley in his Missouri report. Various field experiments are carried on to control the curculio, corn weevil, strawberry weevil, peach aphis, cankerworms, codling moth, rose bug, cabbage worms, etc. We are well provided with machinery for applying insecticides, having five Nixon pumps, upon which we use the ¼-inch hose, with fittings for the large nozzles. We also have a Japy knapsack pump and several Vermorel nozzles, one Lewis combination pump, and the Brooks hand pump, but we use the Nixon pumps and nozzles in preference to all others in our work. Much of our work is distributed in different parts of the State. Numerous lectures have been given before grange meetings, horticultural societies, and farmers' institutes. *Anthonomus musculus* has been very numerous on strawberries in several localities in the State. I found blossoms infested with the larvæ and have bred per-

fect insects from them. We are experimenting with *Botrylus tenella* on the white grub."

I have received no report from Florida, but there is entomological work carried on in this State; the name of the station entomologist is P. H. Rolfs.

Georgia, I believe, is without an entomologist, either in the experiment station or in the State College of Agriculture and Mechanic Arts.

The Illinois College and Station work is united under the charge of Prof. S. A. Forbes. The equipment for work is excellent and the results obtained are among the best in the country. The insectary, which is used in the study and rearing of insects, is one of the best equipped in the country. Library, reference collections, and everything else are among the best. Several assistants are provided by the State. Field control of insect pests and the study of bacterial diseases of insects have been leading features of experimenting in this State.

In Indiana there is no station entomologist, but the subject is taught in the School of Agriculture, Horticulture, and Veterinary Science of Purdue University by J. Troop. I have no report of equipment and facilities for teaching from this institution.

The Iowa department of entomology is quite strong, both in the agricultural college and experiment station. The work in both is in charge of Prof. Herbert Osborn, who is provided with an assistant for the station work. He reports as follows:

"Library facilities embrace the college library, the station library, and my private library. As these duplicate each other only in a few cases the aggregate is an excellent working entomological library, containing almost all of the current entomological literature and many works which are out of print and rare. Of special works I may mention Buckton's British Aphides, Piaget's Les Pediculines, Guebel, Epizoa, full sets of Psyche, Canadian Entomologist, Proceedings and Transactions American Entomological Society, and Riley's Reports as among the important ones. The collections are quite extensive, twenty-four glass-top cases 15 by 18 inches, and two hundred or more boxes (Schmitt pattern) belonging to the Station; besides these the full college sets. They are especially full and valuable in native Lepidoptera, Coleoptera, and Hemiptera, while other orders, especially Orthoptera and Neuroptera, are quite well represented. In many cases the determinations are by well-known specialists, and great pains have been taken in all orders to secure correct identification of species. In Hymenoptera the Ichneumonidæ and Tenthredinidæ are well represented. In Diptera some of the families are fairly well represented with determined material. The Hemiptera, including my private collection, contains an extensive series, and of parasitic insects, especially Pediculidæ and Mallophaga, it is perhaps one of the best in the country. In Arachnida (spiders, mites, and ticks) it is fairly well supplied. In all orders biological material is accumulating rapidly, and some special collections showing insects affecting certain crops are already formed or in progress.

"The section owns a first-class microscope, with powers ranging to a one-twelfth inch oil immersion, and various accessories, and has also at command the numerous equipment in microscopes, microtomes, etc., in the college laboratory of zoölogy and entomology. A breeding room, about 25 feet square, is devoted to breeding cages and equipment for tracing life histories, while root cages are provided for outdoor work and space in the station greenhouse is available during winter or at any time when necessary for special conditions. An apiary is kept, at present consisting of half dozen full colonies and two nuclei, one of which is kept in an observation hive for study. Studies of clover insects are in progress, and experiments upon control of Jassidæ in pastures. We have a variety of spraying outfits and nozzles, hopper-dozers, etc., and supplies of various insecticides, which are tested to determine their merit or their adaptability for certain kinds of insects or effects on certain plants. We have numerous queries regarding injurious insects, and much time is devoted to correspondence. My own time is divided between college and station duties."

From Kansas no report has been received, but we know that the entomological work in that State is well taken care of, both at the agricultural college and the State university. At each of those institutions are located well-known entomologists, at the agricultural college E. A. Popenoe and at the university F. H. Snow. The experiments relative to the control of the chinch bug by means of a bacterial disease have become widely known as work being done at the university, while insect pests of especial interest to the horticulturist are being successfully studied at the agricultural college and station. The principal workers at both of the institutions have assistants provided. The equipment at both is good.

Prof. H. Garman, of the Kentucky Station, writes: "At the station I have charge of entomology and botany as one department and have fitted up two rooms on the first floor for work in these lines. One of these is provided with a desk, a drawing table, and bookcases and is used entirely for manuscript work. The other and larger room is fitted up as a laboratory, with tables for microscopic and insect work and with one large table for bacteriological work, this line being pursued both as a branch of entomological work and as a division of botany. In the laboratory are cases for insects and also for plants. The rooms are provided with gas and water and the usual apparatus, such as microscopes, bacteriological sterilizers, setting frames, breeding cages, racks for vials, etc.

"The collection of named specimens numbers in the neighborhood of 1,800 species. Most of my material is not yet determined.

"In the way of books we have the standard works, such as those of Harris, Saunders, Curtis, Fitch, Riley, Lintner, Lubbock, McLaughlan, Buckton, Westwood, Say, Le Conte, etc., and have the more important serials, such as Proceedings Entomological Society, Philadelphia, Transactions American Entomological Society, Canadian Entomologist, Entomologica Americana, etc.

"In the college I have the department of zoölogy and entomology, and teach the latter subject to all students taking the biological course and those for the agricultural courses. These students are required to make a careful study, using the microscope and dissecting needles when necessary, of types of all important orders of insects; and learn the use of analytical keys by determining material furnished them or collected by them. They are required also to become familiar with common injurious species and with approved remedies for their injuries.

"I have one regular assistant, who helps in both station and college work; when more help is required I draw upon students.

"The station is also supplied with the usual apparatus for spraying and for the application of insecticides."

From Louisiana H. A. Morgan writes that "the entomological department has but recently been added to this institution, and that in connection with another very heavy branch of work, namely, horticulture. Until this summer nothing was done in this line except investigation that might go on without much expense. Early this spring breeding cages were procured, a portion of the propagating house set aside as a temporary insectary, and the different field force pumps and knapsack sprayers were purchased.

"We have a collection already of about forty cases; a great many of the specimens I collected while studying at Cornell.

"Our entomological library is by no means the best; however, our board are gradually feeling the pressing necessity of advancing this work and are furnishing us with good works from time to time. The literature we have is very general.

"Our investigations up to the present have been along economic lines, associating as much of the scientific with our work as possible. We have worked with the screw worm fly, horn fly, sugar cane borer, sweet potato borer, corn bud worm (*Diabrotica 12-punctata*), orange dog (*Papilio cresphontes*), pecan and walnut moth (*Actias luna*), cotton worm, bollworm, and to some extent with many others.

"I have found it very difficult to carry on any work, having the two departments without any assistant in either, in both university and experiment station. I have,

however, persuaded our board to separate the departments and to give me entomology alone, the separation to take effect October 1.

"I am at present working on the orange scales, and have made arrangements for the importation of the parasites upon the red scale (*Aspidiotus aurantii*), which have been recently imported into California. I have also made arrangements for the trial of the hydrocyanic acid gas treatment.

"For teaching facilities I have been furnished with a number of charts and three Auzanx models, also good microscopes and general laboratory facilities."

The entomological work in Maine is in charge of Prof. F. L. Harvey, who states that "The experiment station has no laboratory, but I use the natural history laboratory of the college and my private quarters at my house for experimental work. I am provided with microscopes, microtomes, and other apparatus usually found in biological laboratories.

"We have a collection of 1,000 species of insects of various groups. The college, station, and my private library include the most of the economic entomological publications. We have no specially fitted breeding apartments. I have to use my library, laboratory, and private workroom for such purposes.

"I have been studying the past season for recreation a species of mite known as the verbena mite. I have studied our Maine species of *Thysanura and Odonata.*

"We have force pumps of several patterns."

E. W. Doran, of Maryland, reports as follows: "You are aware that this is the first year here and that nothing has been done here in entomology before. There were no collections worth mentioning and no appliances or library. There is some spraying machinery, such as pumps, etc., in the hands of the horticulturist that can be and has been used by that department in that line heretofore. We have only about 1,000 species of insects in our reference collection, and the library of entomological works is small. Our breeding facilities are meager. I am getting the matter started. No special line of investigations has been carried on, but the work is such as becomes necessary by outbreaks. I am giving nearly all of my time to teaching and get no salary for services at the station."

Prof. C. H. Fernald, of the Massachusetts College (Amherst) writes, in reply to my queries, that "there are two experiment stations at this place, one, the Massachusetts State Station, supported by the State, and the other the Hatch Station, supported by an annual appropriation from the general government. The State Station has no entomologist. I am acting as entomologist of the Hatch Station in addition to my duties as professor of zoölogy in the college and entomological adviser of the Gypsy Moth Commission.

"We have an insectary here for our work, which consists of a story and a half wooden structure with a greenhouse connected with it. The main house contains a laboratory, office, insecticide room, anterooms, etc., with storeroom, stenographer's room, and janitor's room above. The basement contains a pupa room, heating apparatus, coal bin, etc. The greenhouse is so divided that one part can be run as a hothouse and the other as a cold house. In the office we have a library of about one hundred and fifty volumes on economic entomology, and we are well supplied with pumps, nozzles, and other apparatus for applying insecticides both in the field and in the insectary.

"We are making a card catalogue of the literature of North American insects and this already includes more than 25,000 cards. These are made up from the entomological works in my own library, the library of Amherst college, and also that of the agricultural college. This last is very full and contains many rare and valuable entomological works. This card catalogue is exceedingly useful, for when I wish to look up any insect the card of that insect gives all references to the literature.

"We are making up a biological collection of all our common insects, comprising eggs, inflated larvæ in all molts, pupa, imagos, and parasites, also their work on the plants.

"The work done here thus far has been that which seemed to be demanded, judging from the letters that come in from different parts of the State. The work of experimentation is first done here in the insectary and then repeated in the field."

While I have received no report from Michigan, I know that the entomological work in that State is being ably looked after by my friend, A. J. Cook, in the agricultural college. Judging from the amount of work that he has done and the quality of it their equipment must be good.

O. Lugger, of the Minnesota Station, has not sent me a report of his equipments for entomological work in connection with the experiment station and college of agriculture. Whether his facilities for work are good or not, his work has been of such a character as to make some of the entomologists envious of him.

In Mississippi the entomological work is under the care of H. E. Weed, who writes me as follows: "When I came here the station authorities seemed to think that the entomological work of an experiment station should consist entirely of field work, and that no laboratory or anything of the kind was necessary. I was hence given only a 6 by 6 corner in the general office of the station. In six months I was given more space in a room used also for a library for the station. Here I was until last January, when I was given the room I occupy at present. This room is 20 by 20, with a dark room in one corner used in photography. In addition to this I have a building 10 by 15 feet in which I store my pumps, insecticides, etc., and do a little breeding in jars.

"The library, which is chiefly my individual property, consists of about 200 volumes, and is being added to daily.

"The collection comprises only such material as I collected last season and this, and it is contained in 40 Harvard cases. It is arranged in a duplicate collection, a study collection, and an exhibit collection. This latter is arranged so as to show insects injurious to special crops, along with their work and remedies. This collection was exhibited at several fairs last fall and attracted marked attention. Besides the station collection I have a private collection made before coming here, which is used for reference. It is about the size of the station collection, and is especially good in Coleoptera.

"A Coddington lens is the only microscope of which the entomological department of this station can boast, and when a better one is required it must be borrowed from the department of botany.

"The station is provided with the following insecticidal machinery: A Roach poison distributer, Legget's Paris green gun, orchard and garden pump, aquaject, Eureka knapsack, and Woodason's bellows.

"Especial attention has been given during the year to insects injurious to cotton, stored grain, cabbage, and beans."

In the Missouri Station and College the work in entomology is in charge of the professor of agriculture, C. A. Keffer. No report has been received in reference to the equipment and work of this station.

"The department of entomology in the Nebraska Station and Industrial College is under the charge of myself. No provision is at present made for an assistant in either the station or the college. The equipment here is as follows: We have a good reference collection, embracing about 10,000 species of insects of various orders. These are contained in 200 double boxes made by Stromberg, of Galesburg, Ill., 100 Schmitt boxes, two cabinets of the Schmitt pattern, and about 150 other boxes of miscellaneous make. In addition to these we have some thirty display cases of our common injurious and beneficial insects arranged along with their food plants to show their work, etc. Our alcohol material in preparatory stages, our spiders, and myriapods, are contained in about 1,500 vials. Much of this material is as yet unarranged and unnamed. The library, if we include all the works that are contained in the station, college, and in my private set, will perhaps reach 750 volumes besides a number of smaller papers. We lack, however, such works as the principal miscel-

laneous publications of Westwood, Curtis, and others, which are of the utmost importance to the economic entomologist. Our library as a whole is quite complete in works on Orthoptera, on the Aphididæ, Arachniæ, and American periodicals.

Breeding facilities are practically out of the question at present, for the entire department, station and college, is limited to a single room scarcely large enough for a comfortable office. This one room serves as office for the station work, library room, private work room, collection room, breeding cage room, and laboratory for students, of which there are upwards of twenty in different lines of work. Our laboratory equipment for student and private work is fair, there being three high-grade and six good laboratory microscopes in the two departments of the institution. Of wall charts we have all that we desire, as well as other appliances of like nature. These and reference collections with the boxes to contain the latter we have had no difficulty in obtaining; but books and breeding facilities, with machinery for field experiments, though asked for, have not been provided. Consequently, our equipment in these lines is almost entirely wanting.

No special line of investigation is at present under way here. The station work in this line has been almost entirely dropped for the time to give way to teaching. Sugar beet insects have been studied in the field to some extent during the past summer as well as this could be done without funds and appliances. The near future, however, promises to better this state of affairs.

From F. H. Hillman, of Nevada, no report has been received. He is entomologist and botanist for the station and teaches the two subjects in the college.

There does not appear to have been any report from New Hampshire, where the entomology is in charge of Prof. C. M. Weed. That he has the best that can be obtained from the board of control in his State can be relied upon.

A very encouraging report comes from Prof. J. B. Smith, of New Jersey, and reads as follows:

"My laboratory is fully equipped for all kinds of investigation into the structure or classification of insects. The optical aids—lenses, microscopes, and drawing cameras—are ample in every direction. Dissecting tools, reagents, and apparatus for histological investigation are complete, and as a study laboratory I have little left to wish for The library on the subject is very full. We have not only the leading economic publications, but also all the current periodicals, native and foreign, and have in most cases full sets of each journal, including such as the Annals of the French and Belgian Societies, the Berliner, Deutsche, and Stettiner Zeitschriften, and indeed a well selected and full series of the best entomological works. To this I am adding constantly and have nothing to complain of under this head. I may add that we have all the records and publications of like character.

"The collections are good and growing. At present they fill 150 cabinet boxes, 15½ by 18½, and the same number of smaller book boxes, 9 by 13; in the Lepidoptera we have an excellent general collection; in the Cleoptera a well-selected series, representing the American families; and in the other orders chiefly a collection of local forms. This collection, embracing nearly 6,000 species, has been almost entirely secured by myself during the three years of my connection with the station. There are 33 boxes illustrating the economic insects as treated in the station bulletins. The facilities for raising or breeding insects are poor, and I confine this work to the closest possible limits. The State is small, and nearly all parts of it are readily reached by rail in a few hours, so that it is easy to study the insects in the field, and I feel the want of an insectary less than might be the case otherwise. Of insecticide machinery, we have enough to illustrate and make practical experiments. I have the leading types of nozzles, to exhibit and for use. My method of work is to select some one or more crops which are most troubled by insects, fix upon the most convenient points for their study, and spend as much time in the field as is necessary to enable me to learn all that I consider needful concerning the insects. During the present year insects infesting sweet potatoes and the Cucurbitaceæ are being specially studied."

From C. H. T. Townsend, entomologist of the New Mexico Station, we have received the following report:

"I have secured all the standard entomological, zoölogical, and physiological works. I have also 10 large breeding cages, after the Department of Agriculture style; 2 hand spray-pumps, hose, cyclone nozzles; 1 Woodason bellows; a complete outfit for preparing liquid insecticides; 2 achromatic triplets; 50 insect boxes, from Schmitt; 10 gross assorted vials, with rubber corks to fit; and 40 large glass jars for alcoholic material.

"I have no special line of investigation. Everything here is new, and each receives the same attention. I have already notes on 275 species. I also have a large number of fine alcoholic specimens, about 200 vials. Of the 275 species, probably 100 are named, if not more.

"The office, which is in the basement, consists of only one room, and serves also as laboratory and recitation room combined. It is provided with two tables, a desk, two large upright cases with glass doors, for holding insect boxes, vial boxes, and supplies, a letter press, microscope, etc."

Even if there has been no report received from New York we know that the entomology in that State does not suffer for the lack of equipment and a place in which to do the work. Prof. J. H. Comstock, of the Cornell Station, was the first to erect a special building for the purpose of rearing and studying the life histories of insects. Aside from this insectary the institution is one of the best supplied institutions in the land as to library and reference collection.

No report has come from the North Carolina Station or College.

In North Dakota there is no entomologist either in the station or the agricultural college, but this line is attended to in a limited way by Prof. C. B. Waldron, of the college, who is arboriculturist. No special equipment is provided.

In Ohio the subject of entomology receives attention both in the college and at the experiment station. In the latter it is under the care of F. M. Webster, who also acts as a special field agent for the U. S. Department of Agriculture. He reports as follows: "The consulting entomologist is employed jointly by the station and the Department of Agriculture, has no classes, but devotes his whole time to original work, and also has charge of the entomological correspondence. By agreement he furnishes to a great extent his own library, though the station purchases entomological works when necessary. The station has a fair reference collection of insects, and the entomologist also has a private collection which is used in the regular official work. The station has a microscope, with accessories, and a full supply of the latest improved machines for the application of insecticides. The last legislature appropriated $1,000 to be used for the erection of an insectary building on the new grounds at Wooster, and this will probably be in shape for occupancy the present year. It will be equipped with facilities for the study of the development of injurious, beneficial, and other insects.

"While new facts relative to the morphology of any insect will be secured as far as possible, rather more stress is placed upon such as depredate on field crops. While not for a moment losing sight of the value of purely scientific investigations, the stations will lose no opportunity to make such investigations of practical utility to the agriculturist, in whatever branch of the industry he may be engaged. This it hopes to accomplish by a combination of field and laboratory work. The technical features of entomology will not suffer neglect, and it is hoped that at some future time we may be able to publish an annotated list of the insect fauna of Ohio, which shall be of value not only to this but adjoining States as well. For this purpose specimens and notes are being secured whenever an opportunity is offered."

From the Oregon Station, the entomology of which is in charge of F. L. Washburn, we have received the following report:

"The library contains about 70 bound volumes, and about 60 unbound pam-

phlets, insect reports, monographs, etc., also files of the American Naturalist, Entomological News, Zoe, Psyche, Insect Life, etc.

"Insecticide machinery.—A large-sized Bean sprayer, bamboo rods, the new Vermorel nozzles, the Nixon nozzle, the new Bean nozzle, a No. 3 Nixon spray pump, Little Climax pump, and a Leggett London purple gun for dry insecticides; also 10 gopher and mole traps, and a tank mounted on wheels.

"Five Packard breeding cages (old style). Breeding jars. The collection contains about 1,200 insects, representing from 500 to 700 different species. Forty-seven insect boxes in case, collecting tools and mounting material."

"In addition to these the department has, in connection with zoölogy, eleven compound and four dissecting microscopes, dissecting tools, etc.

"Some of the work in progress is experiments with the codling moth, including observations on the date of appearance of moth, length of time required for eggs to hatch, date of egg-laying, and length of life of moth; the comparative excellence of several insecticides; study of the hop louse and experiments against it; experiments with potash salts against cutworms and wireworms; and minor experiments against plant lice, flea beetles, and common pests of the garden."

No work in economic entomology is specially provided for in either the Pennsylvania State College or station.

The Rhode Island Station, I believe, is without a special entomologist. The work in Brown University is systematic rather than economic.

The South Carolina Station is without an entomologist and no entomological work is provided for in the college.

In South Dakota the entomological work is in charge of Prof. I. H. Orcutt, assisted by Mr. J. M. Aldrich. The department is united with that of zoölogy in both the college and station. The report from there is very encouraging. They have an insectary and are provided with six pumps of different kinds, breeding cages, etc. The collection comprises much unarranged material, and about 2,000 named species in all orders, chiefly in Coleoptera and Diptera. The library contains most of the economic and some of the systematic works on American insects. Some experiments have been made with kerosene emulsion as a sheep dip for scab. Experiments will be made on cutworm control during the summer and fall. A collection for the World's Columbian Exposition will be made.

Tennessee is without an entomologist in both station and college.

Texas also seems to be without an entomologist at present.

At the Utah Station the entomologist and horticulturist are the same person, Prof. E. S. Richman. He also teaches horticulture and botany in the agricultural college. No report has been received from there.

The entomological work in Vermont is looked after by Prof. G. H. Perkins, who is also professor of natural history in the University and State Agricultural College. No report has come from there.

From Virginia, where the entomological and botanical work are carried on by Prof. William B. Alwood in both station and college, the following short report has been received:

"For teaching and station work I have seven rooms, main office; private office; private laboratory; main laboratory, which is also lecture room; working laboratory for preparation of poisons, fungicides, etc.; and two small storerooms. This comprises entire ground floor of the main building. The library is my private collection of principal American works and of a few foreign. The collections are mostly private, and comprises about 3,000 species, embracing all orders. Breeding facilities are not good, but cages and greenhouse are used. Field experiments are few, made only to decide upon value of methods; etc. Machinery is the very best and well used. We have placed much machinery throughout the State and taught farmers how to use it. I am working especially upon tobacco insects and those affecting fruits. I have this year an artist assistant, one of my students, and am preparing a number of illustrations, especially on the life history of *Protoparce carolina* and *Chloridia rhexia*."

The Washington Station has no special worker in economic entomology and hence no report has been received.

Mr. A. D. Hopkins, of the West Virginia Station, reports in detail, but the equipment of this station can be summed up about as follows:

A single room 18 by 18 feet, fitted up with desk, bookcase, working table, and insect cabinet containing 36 drawers and 27 insect boxes. There is also a shelf at window for microscopic work, office, and other chairs, with the usual fixtures for work. In the library are something over 200 works on entomology. For working, a good high power and a dissecting microscope with material, and for collecting and rearing insects a good line of material and tools are named, while the equipment of insecticidal machinery is quite complete. The records of bred and collected specimens reach 5,686, while he reports 214 card notes and index and 250 pages of unpublished manuscript. In the collection there are contained 15,100 insects and 1,050 specimens, showing food habits. Some 250 unpublished original figures are also mentioned.

Special lines of investigation are, (1) the study of fruit and forest tree Scolytidæ; (2) the study of and investigation of forest and shade tree insects. All of this equipment and work has been accomplished in a trifle over a year.

While there is no entomologist at the Wisconsin Station, there is a teacher of economic entomology in the college of agriculture. Prof. E. S. Goff has charge of this branch along with horticulture.

Prof. F. J. Niswander, who has charge of entomology in the Wyoming Station, teaches entomology and zoölogy in the university and has charge of the experimental farm. He reports as follows:

"The books of reference are Transactions American Entomological Society, Riley's Missouri Reports, Packard's Guide, and Garden Insects by Treat, with such of the Government reports as can be obtained. I have a dissecting microscope and have to make my own breeding cages, etc. The department gets no appropriations from the board. I have one small spray pump.

"The following outline of work has been submitted to the council: A study of the injurious insects of the season and the best means and remedies for their destruction; the answering of correspondence concerning insect outbreaks, with suggestions as to best methods of destruction, and also as far as possible the study of their natural history; the publication of short newspaper articles from time to time, as occasion demands, giving the most approved methods of fighting insects; instructing the superintendents of the experiment farms with regard to collecting and preserving insects and taking observations concerning insect pests; the building up of a collection of Wyoming insects, to become a part of the equipment of this department; and the preparation and collection of material for the World's Columbian Exposition in 1893."

From J. Fletcher, of the Canada Station, who is both entomologist and botanist, this report has been received:

"The collections are small and are such as have been made since the organization of the Government experimental farms in 1887. There is no special insectary, but as there is no teaching all of our (mine and one assistant's) time can be devoted to correspondence and breeding and remedial experiments. The chief apparatus used are Galloway knapsack sprayers, a pump attached to a barrel, and a hand pump (Johnson's aquaject). The investigations made during part of the year, *Gortyna innanis* in hops, *Hæmatobia serrata* on cattle, *Coleophora fletcherella* on apple, *Fenusa melanopoda* on alder, *Nematus pallidiventris* on poplar, *Ellopia* (?) on oaks, and parasites. I have an unlimited supply of jars for breeding, and free scope to try agricultural experiments in the field. I have been without an assistant until this year, and now I hope to get my collection in order and be ready next spring to do more effective work."

L. Bruner,
Chairman.

The PRESIDENT. If there is no objection, the report will be filed with the secretary. Next is the report of the section on horticulture by Prof. Popenoe, of Kansas.

Mr. FAIRCHILD. Mr. Popenoe is not present nor did he say anything to me of a report to be presented to the Association.

Mr. PLUMB. The question brought up by Gen. Lee was left, as I understood it, to be discussed in the section on college work. As I think it has a wide bearing and many who are interested in the subject would not be able to hear the discussion in the section on college work, I move that this subject be brought before the general session.

Mr. INGERSOLL. There are three gentlemen present to read papers before the section on agriculture on the subject of the teaching of agriculture. I would like to have these papers presented to the general session.

Mr. PLUMB. It seems to me that these papers are technical and should be presented in the sections, but the question raised by Gen. Lee is of general interest and ought to be discussed before the general session.

Mr. HAYS. Prof. Harwood and myself, who are expected to read papers before the section on agriculture on the subject referred to, are of the opinion that if the subject is of general interest the papers might as well be read before the general session.

Mr. HARWOOD. It seems to me that if Gen. Lee's question is taken up now the same thing will be gone over when our papers are read.

The PRESIDENT. It has been moved and seconded that the paper read by President Turner be discussed in the general session at this time. What is your pleasure, gentlemen?

The motion was carried.

Mr. SANBORN. Three years ago, after fourteen years' experience in agricultural education in the New England States and the Mississippi Valley, I was called upon to organize an agricultural college on the Pacific slope. In the several months which I had to think over the subject of organization and the studies to be embodied, I went over the ground very carefully and arrived at some of the following conclusions. In the first place, I read the law very carefully and tried to interpret it for the greatest good to our people. Farmers from ocean to ocean are supplied with agricultural colleges and technical schools of instruction in agriculture. The law under which they exist states that their general purpose shall be to teach the branches of learning—let me emphasize this—that relate to agriculture and the mechanic arts, in order to give a liberal and practical education to the industrial classes.

In organizing our institution we provided five industrial courses, agriculture having a prominent place. At this time I was writing for the agricultural papers throughout the country to interest them in the college. I said, "Agriculture is the leading industry of North America; the law says that we shall teach agriculture, the farmer demands that

every effort shall be put forth in his behalf. We shall do everything possible to make agriculture a leading feature in our institution, but after all it will rest with the farmers to determine whether the agricultural department shall be the leading one. If the demand for the mechanic arts should prove stronger, do not say that we have turned the cold shoulder to agriculture."

We have put our money into a fine farm, have erected buildings, and have established classes in mechanics, horticulture, biology, and other special lines. My friends, the trouble is that there is not a demand for agricultural instruction, and the fault lies not with the colleges but with the farmers themselves. A young man came to me a short time ago with a letter of introduction and said that he wished to enter one of the departments of the institution. I said to him, "I suppose you intend to turn your back on the farm and go into the city." He replied, "No, I am going back to the farm." I asked, "Then why don't you take a course in agriculture?" "Why," said he, "I have just come from farming." The farmer does not perceive that agriculture rests upon science and that until he goes to college and studies the science of agriculture he will be unable to do the best work. One reason why young men leave the farm for the city is the want that they feel of mental activity. When they discover that mental activity is of use in farming they will go back to the farm. The demand for agricultural education is increasing and twenty years from now it will be the fashionable education. In less time than that the tide of migration from the city to the farm will set in.

Mr. FAIRCHILD. May I ask Mr. Sanborn a question? I would like to know whether he can tell us the proportion of students taking the course in mining, mechanical, and civil engineering, and agriculture.

Mr. SANBORN. Not definitely. Of the junior class two-thirds of the students are in agriculture, in other classes the number is about evenly divided between that and other courses.

Mr. HENRY. If there are only three or four in a class that is not significant.

Mr. SANBORN. We have sixty juniors and thirty sophomores.

Mr. FERNALD. Twenty years ago it was my pleasure to attend a convention of the American Agricultural Colleges in Washington, and the principal topic at that convention was how to induce young men to study agriculture, and in every convention down to this time that topic in some form or other has been brought up for discussion. I do not know that we are any nearer the solution of the question than we were years ago. I believe that no question more vital to the interests of our institutions will be raised during the meeting of this Association than this one on which I hope to get light. The law requires that we teach the branches of learning related to agriculture and the mechanic arts. It is my observation and experience that when in the same institution you open the doors to mechanic arts and to agriculture, the young men

will turn toward the mechanic arts. An effort has been made in my own State of Maine to change this. We desire to see the number of young men taking the course of agriculture increased, but we find that even the students who come there for that purpose, when they see that it is better and easier to take civil or mechanical engineering, drop into those courses in large numbers. We can not help it. If the gentlemen here will point out a way by which we can bring equal numbers into these courses they will do us an important service. A farmer will ask me why we do not turn out more agricultural students—more who go back to the farm—but when I ask him what course he wishes his son to pursue, he says he wants him to take a course in civil and mechanical engineering. The farmers send their boys to college to take the other courses. I expect that the same thing is true in every State. New Hampshire has just received an endowment of nearly a million dollars for an agricultural college. I asked Director Whitcher whether they were going to introduce courses in civil and mechanical engineering. "Yes." Then I said to him, "From the first, there is where your students will be." "Yes," he said, "I know it. We can not help it. I expect the students to go into these courses." And they will. If New Hampshire should shut out the department of mechanic arts, making a purely agricultural college, the difficulty would be avoided.

So long as other doors are open the remedy for it has not yet been found. Whether there is a remedy is the question to which we should address ourselves. We might lower the requirements for admission to agricultural students. We have opened short courses, one for two years, and invited the young men to enter, but they do not want to come. We are proposing to open a short course in dairying by winter lectures. But these are really makeshifts and do not meet the demand for an agricultural course. How shall we induce students to take the four years' course?

But even if our agricultural students do not go back to the farm we need not be entirely cast down. When the course in agriculture is taken what difference does it make how the knowledge obtained is applied? I claim that a graduate in agriculture is doing better service for agriculture as director or chemist of an experiment station, or as editor of an agricultural paper, than if on a farm. So when a farmer asks me why we don't turn out more farmers, I make a long answer and it seems to satisfy him.

Mr. LEE. Eight or nine years ago a gentleman just elected to preside over one of the leading institutions in the Southern States when asked what he was going to do, said, "I am going to establish a department of mechanic arts and a department of agriculture, and I shall endeavor to direct our institution so that it shall be entirely in sympathy with agriculture." [Applause.] I hope I may be excused for making a personal allusion.

Why do graduates from West Point make good soldiers? It is because they are educated to be soldiers. When a boy goes to West Point he sees nothing that is not military. When he goes into the library he sees pictures of Scott, Sheridan, Grant, and other distinguished soldiers, and he sees the shelves covered with military books. While he is there his eating, his drinking, and his sleeping are military.

What is the case with our agricultural colleges? There is no industry so attractive as farming. When a man goes to an agricultural college, agriculture should be presented in its most attractive style. He should see the best cattle kept in the best style, should see plowing done with the best plows and the best teams; when he goes into the orchard he should find the very best fruits, and when he goes into the garden he should see the best vegetables. Make agriculture attractive in every way so that when the boy wakes in the morning he will see beauties in the farm.

It is only too evident often that the colleges are not in sympathy with farming. The Mississippi College is young and can not make a comparison with the Michigan and other colleges in the older States, but I can say that our college is becoming somewhat attractive to the farmer. For four or five years alliance men coming by would turn their heads the other way, but the sentiment has changed all over the State. The prejudice is almost broken down and I feel confident that in five years we shall stand in the same relation to our farmers that the Michigan College holds to hers. We shall not be asked by the legislature how much we want, but how much we can use. We expect to conduct our farming so that when a farmer comes there and compares it with his own work he will see the advantage of scientific agriculture. I believe that the lack of interest in our agricultural courses exists simply because we do not give enough attention to agriculture.

Mr. SANBORN. I would like to ask whether anything is done to keep boys from going into other courses which the law is equally clear in requiring us to teach.

Mr. LEE. Only this. We pay students for labor on the farm, but not for working in the shops. I say that the work in the shops is education only and does not deserve pay, but that work on the farm earns money and should be paid. Our mechanical department has been established this year and about one-half of the boys have gone into that department, but I find that they are now coming back to the agricultural courses in order to earn the money paid for the labor on the farm.

Mr. SMART. The question before us is a very old question and has been discussed in the same old way for many years. I want to contribute the speech I have been making for the last five years. I think a good deal of the blame for this thing is to be laid to the tariff, the farmer, the farmer's son, the farmer's wife, the professor of agriculture, and everybody except ourselves. There are many reasons why we have

so few students taking the course in agriculture. They could not be named in half an hour. This is a large question and that is the reason we have to discuss it over and over again. But as to the statement that agricultural colleges are not in sympathy with agriculture, I do not believe it is true and the interest manifested in this Association, year after year shows that it is not true. I believe there is not a man at the head of an agricultural college that is not deeply interested—certainly I am—in seeing the number of agricultural students increased. Each one believes that he is doing just about right now, but I question whether we in Indiana are. I hope that we can spend this afternoon or a good portion of it not in a discussion of ancient history, but in considering, for instance, whether Purdue is doing the right thing. Certainly we are not all doing the same thing, and if one man is doing just right, the others are not quite right. Take the curriculum of Purdue this afternoon and go for it. Knock it to pieces if you can.

While we do not have large numbers in our schools of agriculture, and while we may never expect to have a number equal to those taking the course in engineering, we must not be altogether cast down at that fact. If the students will not come to the colleges the colleges must go to the students. I believe that to be the function of the experiment station. It is a scheme of university extension. The experiment station gives instruction to the farmer by bulletins and by holding institutes, and in this way 20,000 farmers are educated under the direction of the Lafayette station. They seem to appreciate it very much and they doubtless receive large benefits. So every experiment station can go to the farmer as a college and school of agriculture in every county in its State.

We ought not to send out word that this body of college men say that the agricultural colleges are not in sympathy with agriculture. I do not think my friend means exactly that.

Mr. LEE. He certainly did not mean anything offensive, but he did want to call out a frank discussion.

Mr. CLUTE. One gentleman said that he hoped we would not discuss ancient history. It is, however, a fact that by reading ancient history we learn to solve the problems of to-day, and I am inclined to believe that a little ancient history would not be out of place now. The fact that we do not have enough students in agricultural colleges is due in many cases to the fact that the farmers and their wives and friends, from the time a child is born until he is 21 years of age, are continually dinning into his ears that farming is a poor profession. They tell the boy that the farmer works hard and gets small pay, and that he is the tool of politicians, and looked down upon by society. Now all that, constantly drilled into a boy, inevitably leads him to look upon farming as a profession that he should avoid. We have had young men come to us with no intention of becoming farmers because they had been taught that farming was an inferior profession; but four years' training

with our excellent equipment, library, and professors, have in many cases brought these young men, who came to us from the farm disgusted with farming and determined not to enter on farming as a profession, into a different attitude toward farming, and many have gone back home to buy farms and become intelligent, capable, and well-trained farmers.

There are social difficulties that must be considered. The farmer lad does not have the social culture which comes to those engaged in other occupations. This is one of the reasons why our schools of agriculture are not better attended. I think much of the criticism heaped upon agricultural colleges is a great error. If we train up men to teach chemistry in all the length and breadth of the land I claim that we are doing magnificent work.

One of the reasons why our schools of agriculture are not more widely acknowledged and attended is this: They are united with great universities having great departments of Latin, Greek, science, and engineering in its various branches, but only a little space for agriculture. The spirit of the institution is against the industrial course, and a young man going to that school is looked down upon by the rest of the students, and sometimes by the professors, for his grimy hands and coarse clothes. The result is that a young man is almost forced into other courses. The agricultural course will never succeed until you make it important and give it money and appliances.

Mr. HENRY. On the shelves of our agricultural grocery we have had the same things for the last twenty-five years. Our custom has passed away and we have a very small trade. Is that not so? Would it not be well now to look these goods over and study the demands of the trade, in order to see whether we may not better ourselves? Get the sort of goods that people want and you will call in custom.

We have in Wisconsin what we call a short course in agriculture, which I believe goes a long way toward meeting the wants of the people. How did we get it? The man who proposed it was Vilas. At a regents' meeting one of the members read the curriculum for the agricultural course by subjects, one after another, including "Æsthetics." Mr. Vilas followed with a speech remarking the subjects embraced in the agricultural course, one after another, until he reached this item. "Æsthetics?" said he, "Great God, gentlemen, Æsthetics!" From this speech resulted our short course.

This short agricultural course is strictly practical and has been fairly successful. We have also a course of twelve weeks in each of two winters. Why did we make the short course? Why did Mr. Vilas want it shorter? He taught in a law school and knew that a high standard of admission tended to keep out students.

I believe that our courses must be put down, down, down. In Minnesota, the school established by Pillsbury has done more than any other in getting the goods before the people that they want. Mr. Hall is here, and I hope that the college presidents will hear how Minnesota

has been able to get one hundred men each year. Let me tell you, my college-president friends and trustee friends, you have a great question. Was it the engineers, the manufacturers, who plead that more money should be given for education? It was the farmers, the agricultural papers and colleges. It was in the name of agriculture that the money was asked for. But where is there to-day a school where a boy who wants to learn about sheep can learn as much as he can from a shepherd? What professor of agriculture is there who knows half as much about horses as a horseman?

I think it is a shame that we have in our colleges only one professor for all agriculture. In a law college there may be a dozen professors of law, and in medical schools the same. When the colleges have professorships of horses, of cattle, of sheep, of pigs, they will attract the farmer. John's father will say, "John, we have a hundred sheep, and I think you had better go down to that professor and study about sheep. His whole time is given to sheep."

We have registered at our college over one hundred students for this term, and over sixty names entered for the dairy course. Why? Because it is practical. When boys can learn about sheep, pigs, and cows they will go to college, not before. Let us separate the professorship of agriculture into about a dozen parts.

Mr. ALVORD. On behalf of the executive committee, I wish to announce that the programme provides that the sections shall meet this afternoon and organize for work.

At 6:15 p. m. the meeting adjourned.

EVENING SESSION, TUESDAY, NOVEMBER 15, 1892.

The meeting was called to order by Mr. Alvord at 8:20 p. m.

Mr. Broun then delivered his address as president, as follows:

GENTLEMEN OF THE ASSOCIATION: In the annual address to be made on this occasion, in accordance with the custom and law of this Association of Agricultural Colleges and Experiment Stations, I propose to occupy a portion of your time in discussing the educational features of the institutions here represented and their adaptation to the wants of the people.

Education that looks to culture alone, while attractive and elevating in its nature and refining in its influence, does not of itself qualify the recipient for the active duties of life. It simply builds the piers of the bridge to be crossed. There must be superadded to this culture, when obtained by the fortunate possessor, that technical education which will span the chasm that separates college life from actual life.

Milton's definition of education, "that which fits a man to perform skillfully, magnanimously, and justly all the offices, both public and private, of peace and war," is of too general a character to be of value. For, whatever might have been thought possible in Milton's day, it is beyond doubt impossible now for any one person to be so equally well educated in all departments as to be able to perform skillfully all the offices of peace and war.

In former years the older college systems were especially adapted, with their excess of classical culture, to the professions of law, medicine, theology, and pedagogy.

But long since thoughtful men recognized the defect of a system of education that prepared the youth of the country only for the so-called learned professions.

The fact that of the many millions of our people who were engaged in gainful occupations, about one-half were employed in agriculture, and less than 3 per cent belonged to the class of lawyers, physicians, clergymen, and teachers, showed the necessity of broadening our educational system to include this larger class, for which but little special provision had been made. And, besides this, the changes wrought in the varied occupations of life, by the advances made in science and its many applications to the industrial arts, demanded that provision should be made for a wide diffusion among the people of a knowledge of these sciences and their applications.

It was in recognition of these facts that the Congress of the United States made the liberal donation of public lands to establish the American agricultural colleges.

It is gratifying to consider that wise provision of national legislation through the instrumentality of which there now exists in every State and Territory a college, endowed by the General Government, for the education and elevation of the people by instruction in the principles and applications of science. Our admiration for the far-seeing wisdom of its authors, who in that legislation "builded wiser than they knew," increases the more the subject is considered.

By the well-known act of Congress of July 2, 1862, by which the land-grant colleges were founded, Senator Morrill, of Vermont, built for himself a monument more lasting than brass; for thereby his name will be held throughout our entire country in affection and esteem by the youth of the centuries to come, who shall fill the halls of these colleges in seeking that education which shall fit them to become citizens worthy of the Republic.

It would, therefore, I beg just here to say, be eminently proper that there should be placed in the library of each of the land-grant colleges a bust of our distinguished legislative patron as an evidence of our high appreciation of the great work he has accomplished in the cause of education.

The historic period in which the act of Congress became a law suggests a somewhat parallel instance in the establishment of a celebrated European university.

The historian tells us that hardly had the sound of the Spanish artillery ceased to be heard across the plains of Holland when Leyden decked herself with flowers in honor of the founding of the great university which has for centuries cast the light of science and learning to the remote parts of the earth. While Leyden was founded as a memorial of peace, our colleges were founded in the hope of peace and the preservation of the Union.

Just thirty years ago, when all the energies of our country were being consumed in that terrible internecine struggle; when war, with its consuming blight, was alone the subject of thought and object of action; then, with a wise foresight rarely equaled, with a sublime faith in the future of our country, did Congress set apart and devote a vast portion of the public domain to the several States, in trust for the collegiate education of the generations to come. This act alone will signalize in history the Congress of 1862. A century must elapse before its beneficial effects on the education of the people will be duly appreciated.

As it was only possible once in the history of the world for America to have been discovered, so it was only possible once for the consecration of this large area of the public domain to the cause of education. And as the historian of the future traces the development of civilization in our Republic and investigates the causes which have contributed thereto, the legislation which established these national colleges of science and the arts will be classed as a prominent factor. This affirmation is based not so much on what has been done in the field of education by these institutions as on the promise of the future; on the broad view and purpose expressed in the charter, as given in the act of foundation; and on the fitness of the character of

education, designated as the leading object of the colleges, to the wants of the people and to the demands of the age of science in which we live.

At first many of the States, generally from economic considerations, associated these colleges with their State universities; others founded independent institutions. But in recent years the tendency has been in some States to dissociate and establish separate colleges, from a belief that thereby the object of the educational grant could be better accomplished. But whether they existed as coördinate parts of State universities or as independent institutions, one familiar with their history can not fail to have observed that in the early days there existed a widespread prejudice against the character of education proposed to be given. They were in many places regarded as inferior colleges for an inferior class. And possibly in some instances the mistake made in the organization and schedule of study may have furnished apparent cause for the existence of such prejudice.

The function of the college was without doubt often misunderstood, and misapprehension in the popular mind was due largely to the name the colleges bear. By many they were thought to be colleges established for the sole purpose of making farmers of their graduates, that they were professional schools established for the purpose of educating boys to be farmers, similar in that respect to the professional school for educating young men to be lawyers and physicians, and often the college experienced severe criticism if its graduates should prefer to adopt some other vocation. In the opinion of these critics a land-grant college failed of its object just in proportion as its graduates failed to adopt farming as a profession, and its success was considered proportionate to the number of farmers among the alumni.

This contracted view of the object of these colleges has now largely yielded to a more generous appreciation of the object of the grant; to a better understanding of the broad and comprehensive plan of the charter, as contained in the act of Congress; as well as to a more correct appreciation of the relation of technical to liberal education, and to the acknowledgment of the high privilege and right of an American boy to select his own vocation.

The leading object of our colleges is, as expressed in the original act, "to teach such branches of learning as are related to agriculture and the mechanic arts;" and while it also includes military science, it does not exclude classical studies. This is broad, comprehensive, wise, not narrow or contracted. The leading object is to teach the principles and the applications of science, to teach subjects that relate to the useful arts, and while culture, by the study of the classics, is not excluded, it is not the leading object. It were needless before this association to name the different branches that relate to agriculture or the many departments of exact science that relate to the mechanic arts. All these constitute the direct object of the instruction to be given.

In the first years of the history of these institutions attention was paid generally to agriculture and its branches, to the exclusion of the mechanic arts. This resulted not only from economical considerations and from the larger interests involved in agriculture, but also from the inability at that time to teach the elementary forms of mechanic arts as successfully as is now done in the modern method of manual training.

From an experience of eight years in an institution where a well-equipped laboratory of mechanic arts constitutes a part of its educational equipment, I can not express with too strong emphasis my appreciation of the beneficial effects of the modern method of teaching what is known as manual training. All present are familiar with its methods and the educational controversy in regard to its merits as a means of education. Some enthusiastic advocates have probably pressed its claim with too much ardor and demanded that it should occupy too exalted a position among the methods and subjects that are generally recognized as means of education. Be that as it may, its true value is now recognized by educators. It has come

to stay, and deserves recognition in the lower classes of a collegiate course, but only as a means of discipline.

Its object is not to make mechanics nor the making of things, but the making of men. Its methods develop order, accuracy, perseverance, and self-reliance, and while imparting manual skill and giving strength to the body its exercises tend, in a very marked degree, to develop the constructive and executive faculties.

Drawing, which gives the ability to express the concept graphically, is also an essential element of a scientific education, universally recognized to be of value. Hence a school of drawing as an adjunct to the school of mechanic arts is a necessary department of a land-grant college; and the manual training received from the series of graduated exercises given in this school, when combined with the study of science as practically taught in the different laboratories, gives an education eminently fitted for the American boy of the nineteenth century. Moreover, the wisdom of the charter of these colleges, in requiring that provision should be made for education in those branches that relate to mechanic arts, is made manifest when we consider their relation to the necessities of civilization.

The studies that relate thereto are studies that relate to active life. The arts by which raw material is converted into food, clothing, and shelter for civilized man, by which towns and cities are built, by which rivers are spanned and roads constructed, and by which manufacturing is rendered possible, these, and all that mark the progress of the present century, are directly or remotely dependent on the applications of mechanic arts.

The relation that technical education has to modern civilization and the benefits to be derived therefrom are apparent to all observant minds. Daily observations show the advantage of skilled and intelligent labor over that which is ignorant and unskilled, and make evident the important part that educated industry has in modern civilization. These facts clearly demonstrate that for a state to equip her youth by proper education for this industrial age, to plan wisely for the future, she must encourage and liberally support technical education.

In view, therefore, of the prominent position mechanic arts now occupy in many of the land-grant colleges and of necessity must occupy, it would seem eminently proper that this Association should also provide a department or section devoted to the consideration of subjects related thereto, where our colleagues in these departments may discuss methods and improvements for the benefit of all concerned.

The relation that technical education bears to liberal education is more generally appreciated now than formerly. In the early history of some of the colleges we represent it is probable that too much attention was paid to mere muscular education, not recognizing the fact that if energy is consumed too largely by muscular exertion there will be but little store for mental effort. There is no true education in drudgery, in mere muscular labor, when the brain is not exercised. Colleges were not founded to teach manual skill, but to teach brain skill, to develop mind and character. And merely learning how to do without learning the why is empirical, a rule of thumb method, which no educator can approve. In education, principle is far beyond practice, and a knowledge of principle is essential to good practice. Hence technical education to be of value must be founded on a knowledge of principles, on a liberal education; and the broader and more extended the base of liberal education which constitutes the foundation, the more symmetrical will be the column of technical education which forms the superstructure.

By the term liberal education as here used we do not necessarily include or exclude the classics. A fair knowledge of Latin is, for obvious reasons, of great advantage to a boy, and its prosecution is always advised if time and circumstances permit. But a comprehensive knowledge of the principles of science is essential to a liberal education and especially to that liberal education which is to constitute the foundation for successful technical instruction.

Education in the principles of science must be insisted on if we hope to attain success in instruction in technics. While this is true in every department, it is pre-eminently true if agriculture be the vocation for which the student is to be qualified. But the test of exact knowledge of the principles of science is the ability to put them in practice; hence the necessity of laboratories and workshops in every department of science in connection with our colleges. We have, or, if not, we must have, in each land-grant college laboratories of chemistry, physics, mechanic arts, botany, biology, and of other sciences, where students may learn things, not words; where they may learn to execute; may educate their brains through their hands: may learn science through their finger tips. But scientific laboratory work has its most comprehensive field in agriculture, in horticulture, and in the dairy, for here successful experimentation exacts tribute from almost every other department of science.

Successful instruction in agriculture demands both theory and practice, a knowledge of the principles of the sciences with which agriculture is directly concerned, and a knowledge of the methods of applying those principles to successful practice. Laboratory practice in the field, garden, and dairy is essential, but it should always be educative in character, should exercise the brain as well as the hand. While *why* we plow is best learned at college, *how* to plow is best learned on a farm.

But the function of the land-grant colleges is not solely to make farmers of their students, and where such an opinion prevails the public mind can not, for the interest of education, be too soon disabused of the impression. To attempt such a rôle must of necessity result in failure. Nine-tenths of the boys who attend colleges in the South, if not in other sections, find when they graduate that their capital on which to begin life is their education alone. On their brains and hands they must depend for success. They can not engage in farming without a farm, and this, as a rule, they do not possess; hence they must begin as wage-earners, as teachers, engineers, chemists, or in whatever capacity their education and environment render possible.

But, should favorable circumstances render it possible for the young graduate to begin life as a farmer, it does not necessarily follow that he will make a successful farmer. When the conditions of land and market are favorable success in farming comes of practical experience, close observation, and executive ability, with untiring energy and good common sense, qualities that no college that exists or may exist can impart. But yet a good science education, such as is given in our land-grant colleges, is the best possible preparatory training for success in this honorable vocation.

We maintain, therefore, that the function of the land-grant colleges is not to make farmers of its students (and in saying this we are simply repeating the well-known opinion of the legislative founder of these institutions), but to make men; men with educated brains and skilled hands, ready and willing to work with both brains and hands in whatever vocation they are best fitted to perform the duties of life.

There is another view, worthy of consideration, which necessitates a broad and liberal curriculum, as required in the act of Congress.

The freedom and possibilities of American life differ from the fixed relations of an older European civilization, where the son is expected to adopt the vocation of the father. American freedom protests against a system that would educate a class of boys for one vocation only. The right of an American boy to carve out his own fortune and to adopt any vocation that his inclination and talent may lead to and his judgment approve, should not be abridged by an educational system designed to prejudge his future and train him for one vocation only. He does not measure his possibilities by his father's attainments. He may be farmer or physician, teacher or lawyer, merchant or mechanic, preacher or president. Hence our agricultural colleges should not be modeled after the plan of the European. They of necessity must

be broader and more liberal in their educational schemes in order to adapt themselves to American civilization.

While these views are not new to the members of this Association, still they needs must be in many sections emphasized with insistence, in order to give a just impression of the educational work we are endeavoring to do and are required to do under the law establishing these institutions.

They constitute on the one hand the argument for breadth, for liberal education against narrowness, which is sometimes charged by adherents of the old classical culture, who contend that there is no place for an agricultural college in the American system of education; and on the other hand they furnish the argument for liberal education against the empirical technical instruction that even yet in many sections agricultural friends contend should be the limitations of the educational sphere of the land-grant colleges.

The growth of these institutions, their influence in causing older colleges to modify their courses of instruction, the high esteem in which they are held by men of learning as educational centers of power, the life and energy they manifest in every State, furnish an answer to each class of critics and give assurance of an influence for good that will widen with the years.

Our Association represents not agricultural colleges, but American agricultural colleges; broad institutions, adapted to American civilization, and not imitations of those which exist elsewhere and are adapted to an older civilization where class education is recognized. They are the product of our civilization and of the century in which we live and represent not the old, but the new education, and this so-called new education makes no protest against the old classical system, which has for centuries held the gateways of the temple of learning and trained, disciplined, and refined human thought and expression. It is not revolutionary, but supplementary, and seeks to build up and develop American civilization by making the leading object not linguistic culture, but scientific training.

Our colleges represent the legitimate outgrowth of the progress of science and the demands of the century. They must grow in harmonious development with the age in which they exist and must not cease to grow, for with a college the cessation of growth is the beginning of decay. Their faces are turned toward the future and not toward the past; hence their chief concern must be about the studies of the present and future.

In the former centuries it was not useful knowledge, but polite learning, not the laws of nature, but the laws of language, that were deemed worthy of study.

No one knew a century ago that steam would revolutionize the world and change the methods of human industry. No one knew that it would enable England with its limited area and population to do the work that represents the equivalent of the manual labor of all the able-bodied men of the world, but the fact is it has changed the face of the civilized world, entered every department of human industry, and largely modified our educational systems. It is then no longer a question whether science shall be taught or not. The spirit of the age demands it, and the question now is, in the limited time that can be devoted to education, how much of the old can be retained?

We have reason to be thankful that the colleges represented by this Association have their faces turned toward the future, and that there is established in every State of the Union a college that exalts *useful* knowledge and educates its youth for the future and not for the past.

But some contend, though at present the tendency is to a more liberal view, that education in science is inferior in character and in discipline to the old form of education of the classical colleges. Were this the proper place for controversy we might assume the aggressive and challenge comparison of the results of the centuries of educational work under the classical curriculum with the achievements of

the scientific schools of recent times. If fruits are the test of merit, the decision would not be doubtful.

In defense of the discipline that is the result of the study of science, we may briefly say that its study gives thought and tone to the mind, cultivates accuracy of perception, discrimination of judgment, closeness of observation, correctness of reasoning, and imparts a love of truth rather than of victory. And further, by its study of the concrete rather than of the abstract, by its constant looking for the relation of cause and effect, the mind is familiarized with the true spirit of inductive philosophy, the philsophy of daily life, and thus in its educational effect is demonstrated the truth of the definition that science at last is only "refined common sense."

Our contention is that the education given by the scientific and technical schools holds no inferior, but for many vocations, a superior rank. For it gives an educated man power in practical life, gives self-reliance and trains executive ability, gives true manhood, and looks to life in its wider aspect and not to self for culture's sake. Culture is a luxury for education, but science is a necessity, a necessity for all the people.

There is one feature of our colleges that in this brief review should not be omitted. The charter makes instruction in military tactics imperative, and to emphasize the obligation the general government has made provision to furnish to each institution a qualified officer to give the requisite instruction, and thereby we have the excellent instruction of the U. S. Military Academy extended to the thousands of young men of the several States who attend the colleges here represented.

The military instruction and training received makes of the young men citizens of more value to the State and the Nation. They constitute material for the trained military reserve, ready to support the arm of civil authority should occasion require, and hence are an element of power in our midst, which, increasing with the years, tends to conserve our civilization.

That military instruction is required is a mark of the wise legislation that formulated the charter, and fidelity to the trust requires that all its provisions should be faithfully executed. The report of the Commissioner of Education for 1889 shows that 54 per cent of the 10,000 students in the land-grant colleges received instruction in military tactics, a gratifying result, furnishing evidence that the trust is executed in accordance with its requirements.

But this Association represents not only agricultural colleges, but also the agricultural experiment stations connected therewith.

Experience confirmed what reflection anticipated, that agriculture neither as an art nor as a science could be largely promoted by teaching college students the elements of the sciences related thereto.

The agricultural colleges at first largely failed to win the confidence of the farmers, those whose interests they were especially designed to promote. They were criticised for not accomplishing an impossibility.

The unsolved problems of agriculture demand for their solution the profound study of the best scientific experts, and are to be solved only by accurate scientific investigation and experimentation continued through successive years.

The necessity for means and men to conduct this scientific research and investigation of the varied subjects related to agriculture was first recognized by college workers; and public opinion, largely created by their influence, was formulated by Congress in the act of 1887, establishing the agricultural experiment stations. By this act there was made by the general government a munificent endowment for research, and thereby has been established in every State a corps of scientific experts, whose duty is not to teach but to investigate, to investigate scientifically subjects that relate to agriculture.

No government ever before paid a higher tribute to the value of science or made a more valuable contribution to the interest of agriculture, on which all other depart-

ments of industry depend. Provision was made both for discovery and dissemination. This important supplement to the agricultural colleges has given to the farmers of every State a corps of scientific officers to work exclusively for their interest, and has wisely provided that the results of the investigations shall be brought home to them in the form of printed bulletins. The investigations have already borne fruit in the discovery of important truths and in the dissemination of knowledge of value to the farmers, and in the coming years benefits of inestimable value must accrue to agriculture.

The officers of the station have a great work before them—one worthy of the best labors of the best men. They have to call forth their best energies, not only the stimulus of devotion to science in the search for discovery, but also the satisfaction of knowing that what may be discovered of value to agriculture will cause its authors to be esteemed in the years to come as benefactors of the human race.

But the growth of these colleges during the quarter of a century of their existence and the progress of science demanded that they should be provided with enlarged and improved scientific equipment, with a larger staff of officers, with better libraries, and improved facilities of instruction. And the Congress of 1890, with marked unanimity, happily under the leadership of the distinguished author of the original bill founding these institutions, passed the act granting an additional endowment, increasing for specific purposes the income of each college.

By this last and third Congressional act, the colleges have a pledge of confidence on the part of the general government of which every incentive that ennobles human nature demands that they should prove themselves worthy.

There should be no steps backward. We must, as earnest Christian teachers, as true students of science, work continuously and earnestly, and execute faithfully the great trust committed for the present to our keeping. It is a great trust for the benefit of the people, all the people and not for any special class.

The admirable form of government under which we live is illustrated in the relation of these national schools of science to the States and the General Government. The colleges, though endowed by the general government, are subject only to State control under conditions imposed on the trust. These conditions inhibit the use for building purposes of the income from two of the grants and permit a small expenditure from the third.

Hence, in accepting the trust each State imposed on itself the obligation to provide for its college all buildings that are necessary to a full realization of the objects of the national grant. The reports show that this obligation has been complied with in a liberal manner, by large donations from the State legislatures and from other sources, the value of the gifts to these institutions in land, buildings, and equipment, being in excess of $5,000,000. By this provision the interest of the State in the college is increased and the endowment is preserved undiminished. It is held by the States in trust, in perpetuity, and cannot be squandered or lost by mismanagement. Hence our colleges are permanent institutions resting on a foundation as secure as the Government itself.

From the last published report of the Commissioner of Education, for the year 1889, we find that the thirty-two land-grant colleges named therein had 700 officers of instruction, with nearly 10,000 students; that they enjoyed an annual income of $1,500,000, with an endowment of $10,000,000; that the value of their grounds and buildings was estimated at $6,000,000, with a scientific equipment valued at nearly $1,000,000.

And further, as significant of the growth of fourteen colleges there reported, in the five years from 1884 to 1889 the number of instructors had increased 30 per cent and the number of students 50 per cent.

It is true that several of the institutions given in this report are State universities, but were we able to present the reports of the fifty-three land-grant colleges established in 1892, limiting the statistics strictly to these colleges and the corresponding

departments in the universities, the figures given would not be diminished, but largely increased. Besides the colleges, this Association also represents fifty-one experiment stations, with a staff of over 500 officers and assistants scattered throughout the States and Territories, working for the promotion of the great interests of agriculture.

The number of students and officers of instruction and investigation, the value of the buildings and equipment, and the amount of the endowment and annual income demonstrate the importance of the trust committed to the officers and trustees of these institutions. They have long since passed the experimental stage and are now recognized as important factors in advancing education and promoting civilization in America.

Our duty is to make the work of these colleges and stations known to the world. And the opportunity presented in the World's Columbian Exposition at Chicago should be improved by presenting, in the most efficient manner, the methods used and the work done. Faithfulness to our trust, as well as the interest of the institutions we represent, demand this. But to make the exhibit worthy of the institutions will require a large additional expenditure of energy and money. That our governing boards are authorized to direct this expenditure, appears evident from the educational nature of a representative exhibit and the wide diffusion of useful knowledge that would result therefrom.

Especially does it follow that an appropriation of funds for this purpose is legitimate, since the diffusion of useful knowledge is named in the act of Congress as one of the objects of the grant. With means available and proper energy there can be made, and should be made such an exhibit at Chicago as will challenge the admiration of visitors, American and foreign; such as will show the beginnings of the great work to be accomplished by the national schools of science and the agricultural experiment stations for the education and upbuilding of our whole country.

In presenting to you these views I beg you to consider the relation you hold to the present and future well-being of our country. You are scientific investigators, working for the improvement and promotion of that industrial art which directly concerns the well-being of the largest portion of the human family. You are observing, noting, comparing the methods of nature's action, in order to discover what promotes or retards plant or animal life. And, whether working with retort, microscope, or pruning or dissecting knife, you are working to ameliorate the conditions of human life, and by showing how better to subdue the earth, to bring increased prosperity and happiness to the homes of the people, you are working not for self, but for the good of humanity.

We are teachers, having under our charge thousands of the youth of to-day, those upon whom the future destiny of our country will largely depend. Let us duly appreciate the magnitude and importance of the great trust committed to our care, its weighty responsibilities as well as its immense possibilities; let us faithfully and zealously execute its provisions, educating the youth entrusted to us so well and so thoroughly in the principles and applications of science that they will show in their lives that love of work, that love of truth that comes from an imbibition, by science study, of scientific method and scientific spirit; let us, looking to the future with an earnest love for our whole country, faithfully work to make the national schools of science here represented the best schools, best in their adaptation to the demands of American civilization, best in their harmony with the spirit of the age, and best in the wide diffusion of a patriotic and Christian spirit among the youth of our country.

Mr. Alvord distributed copies of the revised constitution as reported by the executive committee and announced that it would be considered at the morning session of the following day.

Mr. Curtis, for the program committee of the section on agriculture, announced the following program for the section on agriculture:

Wednesday (1) Details of successful farmer education; (2) What should the professor of agriculture teach?—G. E. Morrow and P. M. Harwood; (3) Soil investigation, E. W. Hilgard (prepared for the chemical section); (4) Relation of the experiment station to the agricultural college, for open discussion. Thursday (1) The field of bulletins, present and prospective, C. L. Ingersoll; (2) The establishment of official methods of experimentation, W. A. Henry and F. A. Gulley; (3) Mistakes to avoid in dairy experiments, H. H. Wing; (4) Forage-plant tests, their scope and plan, C. C. Georgeson.

Mr. Turner announced that the section on college work had requested Mr. Fairchild, of Kansas, to present to the general session a paper on the relation existing between technical and general courses of study, and moved that this paper be presented at once.

The motion was carried and Mr. Fairchild read as follows:

The Relation of Technical to General Courses of Study.

The methods of training for active life have varied from time to time with the ideas of the leaders among educators. The swinging pendulum of thought is found everywhere, and perhaps is nowhere more evident than in the effort to train to most usefulness in the least possible time.

The trend of earnest effort at all times toward special training is natural, for several reasons. It saves time in gaining a living. The specialist can pay his way from the start. Further, it makes haste towards usefulness. One who, saying, "This one thing I do," can do the least of useful things, seems doing well and fills a niche in somebody's plans.

The great advance in division of labor everywhere reveals the fact that such division is profitable, both to the actor and to the world for which he acts. The whole trend of civilization indicates that a little done repeatedly brings perfection in that little. And the whole mechanism of production and exchange tends toward economy in the little perfections. To seek some niche to fill, and fill it well, as speedily as possible, is the end which every youth has set before him in the practical lessons of life.

Moreover, the bulk of human knowledge in our day overwhelms the thoughtful youth and compels him at once to acknowledge the hopelessness of universal information. To expect, like Milton or Bacon, to compass all of science in one's education would be simply preposterous. A mere glance at elementary facts reveals the uselessness of such attempts. Even when one is exhorted to broaden his view of the world by extending his search into the grand humanities, the question instantly arises, which humanities? for every field of study calls for whole libraries and for almost numberless laboratories, with the ever present suggestion of more to follow. Thus the necessity for choice of culture is as evident now to the mere tyro in knowledge as it once was to the philosopher. Indeed the very general discipline of our youthful days through Roman classics and Greek poetry has now become a special training; and that which opened to the view of us elder thinkers a world and a history must now present to our children only the details of a few lives or must occupy a lifetime in searching for the ever-wavering influence of such thoughts in the world.

We must expect, then, the absolute necessity of special thought and special training for all who would maintain their part in this world of active thought. And yet

the dangers from attention to a single field of thought are the same now as ever. These dangers are both individual and social. To an individual mind occupied with a study of facts, however numerous those facts, the view of nature becomes narrow; occupied with few relations, the indefinite detail in those relations seems a universe—yes, even the universe—and other minds are read by the same little signs. The growth of reasoning power is thus limited almost to mere empiricism. The association of fact with fact in a single rut of thinking makes this one rut in the law of nature paramount among relations. Almost no estimate of truth is genuine, for such a mind, held within its narrow confines, so magnifies the nearer objects as to obscure their relation to the rest of nature. Such a view of our universe and its ever-increasing activity becomes shortsighted. Repetition after repetition of the same set of facts seems to make up both time and eternity, and instead of growth and expansion to meet the opening vistas of infinity the confine of the well-worn path occupies all energies. With such habitual views an overweening conceit is most natural and most frequently realized. Nothing so fully sets a man above his fellows, in his own opinion, as excessive familiarity with a few particulars indefinitely applied. The fact that such an individual often finds himself out of sympathy with his neighbors, misunderstanding them and misunderstood by them, too often only exalts his opinion of himself and makes even more exaggerated the tendency to narrowness, unreasonableness, unfairness, discouragement, and self-conceit. Such a result leads, naturally, to conflict in the social life of individuals. All mutual understanding between two persons implies, of course, a common place of thought. Two extreme specialists in different lines have no such common place, lack appreciation of one another's personality, and must fall back upon the simplest talk of weather and crops. A lack of common wants brings partisanship, and argument, for lack of common place and clearness of reasoning, becomes bickering and vituperation. Misrepresentation is inevitable, both as to abilities and needs; and too often the social world is all awry to the several eyes mistrained in observation of a single class of facts.

The world is full of examples. City and country vie with each other in furnishing expert instances, and the ignorance that is hardest to combat is the self-conscious knowledge of a narrow-minded routine worker with a single range of thought. These real dangers it is the part of true education to meet and destroy. No student of educational methods can be willing to be restricted to the laws of the one object of study he selects. His problem is to find a remedy for every evil tendency and yet lose none of the trend of nature in the growth of humanity toward its perfection of accomplishment.

The remedy of our earlier days for the narrowing tendency of technical training was to divide all growth between two periods: one of discipline, in which the range of knowledge is the mere gymnastic field for youthful energy of mind, and the other of training in the chosen profession through application of the wider range of particulars implied in discipline. This assigned all technical courses to a university where, by assumption, only disciplined minds were gathered. The long preliminary course of purely general knowledge was followed by a brief training in technical application. And yet the whole was far too slow in perfecting the work of the best minds and wholly inadequate in adaptation to growth from mediocrity into superiority. Too often the ardent earnestness of youth for accomplishment was wholly quenched, and multitudes became mere timeservers in vain speculation about the universe, while knowing nothing of the details of life and learning. The exhortation, not uncommon, to await developed powers before selecting applications for such powers, was quite like the ludicrous maxim, "Never go near the water 'till you have learned to swim." The actual swimmers in our earlier days in the seas of actual life were chiefly those whose necessities compelled daily application of ingenuity in details as a means of accomplishing discipline of mind in the general course of study.

The later remedy, and the better, for extremes in specialization, employs a unity of ideas, both special and general, concrete for the abstract and abstract in the concrete, embracing, if possible, all activities at once. This must recognize all knowledge sought in relation both to self and to humanity. "Truth for its own sake" means, in this connection, truth for its importance in the range of possibilities. Each step in advance is made upon the foundation laid in past activity. And yet the broader views of older students or of teachers are the constant stimulus to greater activity. All knowledge has its meaning with reference to some line of active expression, and that expression is its meaning in relation to all humanity. This implies that each student shall find by natural contact with the things about him the line of ingenuity which shall make him most useful to his fellow men. Instead of regarding his trade or his profession as simply a means of living, he naturally finds it a means of giving a larger life to his fellow men. Philanthropy is from the start a stimulus to exertion, because the active energy is made to illustrate the united interests of society, a nation or a world. With proper teaching the ingenious youth is led to find a blending of all sorts of relations through a great variety of studies adjusted here, there, and everywhere to his particular energy, and may grow continuously in breadth and in power. His world is an unlimited world, though self-centered, and he quickly outgrows the conceit of superior ability, by finding almost everywhere his need of equally important abilities in his neighbors.

I believe that the practical methods of training of our day may accomplish a truer growth than the extended courses of the past; but they must seek to do more than to simply perfect in dexterity and to foster the special ingenuity of students. It is possible in a course of four or five years in the common schools to embrace the the essentials of a good education. It will lead to the arts of life and bring actual results, but will at the same time give those liberal views of human nature in the midst of outer nature which insure freedom of thought, clearheadedness, and practical wisdom. I would have such a course embrace the commonplaces of knowledge with actual service at each step in the common life of humanity.

To furnish the commonplaces, I would be sure, first, of accurate speech; and that because humanity needs it and each needs it to understand humanity. Second, such a system of reckoning as will cover all possible problems, but illustrated continually by the everyday problems of training. Third, systems of reasoning, inductive and deductive, not simply illustrative, but used in every phase of duty and accomplishment. Fourth, as complete an analysis of the universe as elementary statements and questionings can bring. Mathematically, the student should, as a friend of mine expresses it, see into space. Mechanically, he should test matter by all the senses and with many contrivances for producing and estimating mass and motion. Physically, he should experience force and comprehend conservation of energy at every turn. Chemically, he should experience order in the lines of his daily thought; the precision of manipulation should give him accurate conception of the universal law of atomic order. Organically, the world should touch him by enough of the animal and vegetable kingdoms in everyday surroundings to reveal the laws of growth, structure, and function in infinite variety. Intellectually, he should find himself the representative of all past experience, still reaching after a richer experience and to a fuller comprehension of the universe. Morally, he should find duty chief, and rights a consequence of rational effort to be of all possible use to fellow beings. This analysis does not require the history of thoughts about such problems, the pros and cons of controversy, or the quibbles of detail and description, but it requires ingenious application of the actual facts of daily life.

I would add as full an acquaintance with the world's experience—industrial, literary, and political—as will add to rather than detract from the interest in every day's experience. The very elements of knowledge embraced in the general range of the sciences can furnish suggestive materials, and well-stored libraries will arouse curiosity and incite to constant research.

All these commonplaces of knowledge may find their application in the so-called common life of humanity. The food supply, the shelter, and the mechanism of art touch every man's being and afford no end of illustration of the growth of knowledge and the power in wisdom. See to it that students have to do, by actual exertion, such parts of the world's tasks as concern most of the race. In this daily adjustment of tasks they may find that knowledge is not a garment worn for show, but their weapon of warfare against want, against weakness, or against brutishness, or their means for climbing to the summit of enjoyment.

Technical ingenuity, thus developed gradually among general ideas of usefulness in purpose, is not narrowing, but broadening, liberalizing, while it opens the way to perfection in the arts of life. It gives a real choice among pursuits that add to the welfare of the race, with less chance of bias from mere whim or curiosity. It builds character and power together.

Now a word as to details, and for these I can do no better than to outline in brief the plan pursued for the past dozen years at the Kansas State Agricultural College. An itemized statement of principles may suffice.

(1) Admit directly from the common country schools and if possible without a preparatory class. A college for the people must go to the people in its plans.

(2) Give as early as possible, with English and mathematics, an introduction to nature through drawing and botany, with mechanical training in simple construction applicable to every kind of life.

(3) With chemistry and mineralogy apply science in agriculture, horticulture, economic entomology, and household economy, with practice in all.

(4) With mathematical mechanics, agricultural chemistry, and physics, give a training in surveying—the basis for our title to our homes—and common engineering, suitable to all sorts of construction, exercising ingenuity in the same problems upon the farm and gardens, and in the shops for wood and iron work.

(5) Enlarge the scope by more general problems in thinking and reasoning, illustrated still by everyday facts in plant life, animal life, geology, and history and social economy, with technical trial in the arts of construction and production.

(6) Keep students thinking all along the line of the industries which employ the race and give our civilization.

(7) Make the faculty a unit in their sympathy with the purpose and methods of the college in training for the various pursuits of life.

(8) Interest the body of students in the object sought, and arouse a pride in their own institution as a foster mother in the useful arts, showing results worthy the praise of the people.

(9) Bring the college work to the people by institutes, by lectures, and by every means of direct contact between faculty and patrons, with especial care to bring to the front, in interest and useful effort, the graduates and former students whose good work and growth are proof of accomplishment of the grand purpose of the college.

(10) Cultivate the interest of absent alumni in the growth and advancement of their alma mater.

Mr. FERNALD. I am not quite willing to admit that the efforts along the line of agriculture have been unsuccessful. There are different methods of judging success. In the State which I represent there is great interest. There were 1,200 visitors—farmers, their wives, sons, and daughters—on our campus on the 15th of last June, and they went away friends of the institution.

Even though the majority of students do pursue the engineering courses, I do not believe that we are not accomplishing the purposes of the act of Congress. The State of Maine is fast becoming a manufacturing State, and we may be performing our duty, even though

not so many as we would desire follow courses of agriculture and become farmers. The point I wish to make is that we can not, under the law, conduct only the branches relating to agriculture and shut out the mechanical branches.

The question remains how can we induce a reasonable number to study agriculture? I think there is great difficulty in doing this. I do not say it is essential that we do this, but in view of the demand that exists in all of our States that we turn out more farmers, I am anxious to know how it can be done. I want to know how, when the different courses are put side by side and young men are allowed to choose for themselves, we can induce them to take the agricultural course in preference to others. According to my observation, the tendency is the other way. Can a remedy be recommended by this Association.

Mr. TURNER. This question suggested itself to me when reading the reports of the different colleges. It is a very important question for the institution which I represent. We are just establishing a department of mechanic arts and for the first time have a separate course in agriculture, but the difficulty that Prof. Fernald refers to has already suggested itself to me: how can we make the agricultural course attractive to students? It seems to me that the intent of this law is to give students a liberal education, including the branches of learning that underlie the art of agriculture, and not simply the practice of it. In order to attract students to the agricultural course must we abandon the sciences which underlie agriculture and teach only empirical science? It seems to me that that is the question.

Mr. JOHNSON, of Connecticut. My theory has been, and my practice is, to have a fundamental course which underlies both agriculture and the mechanic arts. Our course does not separate the two. We have instruction in greenhouses, laboratories, shops, and barns for all young men who take agriculture, horticulture, shop training, and mechanic arts as a basis for growth. In the last year only do we allow any departure from this, but we provide in the post graduate courses for special training along the lines developed before. We have not as yet found the least thinning down, though our State is rapidly developing in manufactures.

Mr. CURTIS. The agricultural section has on its programme a paper from Prof. Harwood on this very subject, and I suggest that further discussion on this matter be postponed until after the reading of that paper.

On motion of Mr. Alvord the meeting adjourned at 10:15 p. m.

MORNING SESSION, WEDNESDAY, NOVEMBER 16, 1892.

The meeting was called to order at 9:20 a. m.

Mr. Alvord submitted the new draft of the constitution prepared by the executive committee.

The PRESIDENT. The report before you is a substitute for the present constitution and will be read by the secretary by articles.

The secretary then read the first article:

I.—NAME.

This Association shall be called the Association of American Agricultural Colleges and Experiment Stations.

The PRESIDENT. If no amendment is proposed we will pass on.

The secretary then read the second article:

II.—OBJECT.

The object of this Association shall be the consideration and discussion of all questions pertaining to the successful progress and administration of the colleges and stations included in the Association, and to secure to that end mutual coöperation.

The PRESIDENT. The secretary will read the third article, if there is no objection.

The secretary read the third article:

III.—MEMBERSHIP.

(1) Every college established under the act of Congress approved July 2, 1862, or receiving the benefits of the act of Congress approved August 30, 1890, and every agricultural experiment station established under State or Congressional authority, the Bureau of Education of the Department of the Interior, the Department of Agriculture, and the Office of Experiment Stations of the last-named Department, shall be eligible to membership in this Association.

(2) Any institution a member of the Association in full standing may send any number of delegates to the meetings of the Association, but one shall be designated to the Association as the regular representative and voting delegate. The same delegate may represent both a college and a station, but shall cast only one vote in general sessions. Other delegates may be designated by any institution to represent it in specified sections of the Association, but such delegates shall vote only in such sections, and no institution shall be allowed more than one vote in any sectional meeting.

(3) Delegates from other institutions engaged in educational or experimental work in the interest of agriculture may, by a majority vote, be admitted to conventions of the Association, with all privileges except the right to vote.

(4) In like manner, any person engaged or directly interested in agriculture, who shall attend any convention of this Association, may be admitted to similar privileges.

Mr. HADLEY. I rise to ask for an explanation. In section 2 I read, "The same delegate may represent both a college and a station, but shall cast only one vote in general sessions." Does that mean that an institution having a delegate from the college and one from the station will have two votes, and that an institution having but one representative for both college and station will have but one vote?

Mr. ALVORD. That is the intention. The longest discussion at any convention of this Association, in my recollection, was upon that point, and the rule as it stands was settled finally by a large vote. The com-

mittee did not feel disposed to interfere with that decision of the Association made three years ago.

Mr. HADLEY. An institution situated near the place of the convention is likely to have two representatives, and therefore two votes; but an institution very far away from the place of meeting may be able to send but one delegate to represent both the college and station, and will therefore have but one vote. Is this fair?

Mr. ALVORD. I do not wish to reopen the discussion of three years ago, but in a very few words I can give some of the reasons which led to this rule. First, it was thought best to keep the proxy system in any form out of the constitution. Second, it was hoped that the rule might induce the various colleges and stations to send a full representation.

The PRESIDENT. There must be some motion made to make a change.

Mr. TURNER. I move to substitute for the clause "only one vote in general sessions" the clause "a vote for each institution."

Mr. HADLEY. I second that motion.

Mr. NICKERSON. I suppose the words should be permissive and not mandatory.

Mr. WOODS. There has never been a time in the history of the Association in which any matter, however important, has ever called out all the votes. If we extend the right of suffrage to two institutions represented by one member, shall we not be obliged to extend it to the institutions not represented at all?

Mr. FERNALD. Another point to be considered is that this Association meets in different parts of the country, so that the proximity of different institutions will about even up, year after year. I think the provision should remain as it is.

Mr. HADLEY. I suggest this form for the amendment: "And may cast one vote for each institution in general session by him represented."

Mr. HUNNICUTT. I suggest that it read in this way: "The same delegate may represent both college and station by vote in the general session."

Mr. SCOVELL. I think the provision is better as it is because it gives us a larger attendance at the meetings. I am inclined to believe that many boards of control would send but one delegate if he could represent both the college and station in voting.

Mr. FREAR. I think it desirable to enforce that point. I know personally of many institutions which would be represented if only the wishes and judgment of the officers in charge were acceded to. Sometimes those who hold the purse strings are not in accord with the officers of the stations, and unless pressure from the outside is brought to bear will rely upon their own judgment rather than upon that of the officers of the station. It seems to me that the clause should stand as it is.

Mr. ARMSBY. While I am in favor of the provision as it stands, it occurs to me that it might be subjected to a slight modification. The clause as it stands and the whole practice of the Association recognize the stations and colleges as in a sense distinct institutions, on account of the different character of the work undertaken by them. It seems to me right that if an institution, either a college or station, is not sufficienty interested in the work of the Association to bear the expenses of sending a delegate, it is not entitled to a vote in the convention. If this phrase is modified, I would suggest that it be made to read "that no delegate may represent more than one institution," meaning by institution either college or station.

Mr. HADLEY. I wish to say one word in the matter of illiberality. Some of you are probably not aware that every time a meeting of this Association is held it costs New Mexico from $200 to $300 to send a delegate. Last year we sent two delegates to the convention. So you see it is a matter of money, but hardly a matter of illiberality.

Mr. ATHERTON. I recognize the force which the point made by Mr. Hadley must have from his point of view, but in the majority of institutions which belong to the Association it does not apply. It seems to me that it would not be well, in the present condition of the Association, when it is wielding such a power among the institutions, and from the outlook promises to wield still more, to jeopardize its strength by changing the constitution so as to lessen the attendance at the meetings. I hope therefore the section will stand as reported by the committee.

The PRESIDENT. I will put the motion to vote. The motion is lost. Is there any other amendment to article 3? If not the secretary will read the next article.

The secretary then read the fourth article:

IV.—SECTIONS.

(1) The Association shall be organized into sections upon (1) college work, (2) agriculture and chemistry, (3) horticulture and botany, (4) entomology. The executive committee shall, upon the request of any ten institutions represented in the Association, provide for the organization of provisional sections at any convention.

(2) Each section shall conduct its own proceedings and shall keep record of the same, and present a synopsis thereof to the Association at the close of every convention; and no action of a section, by resolution or otherwise, shall be valid until the same shall have been ratified by the Association in general session.

Mr. PATTERSON, of Kentucky. I think we ought to add to the sections one on the mechanic arts. These colleges by the terms of the law are mechanical as well as agricultural, but the mechanical side, so far as I am aware, has never found recognition in this Association. In many of the land-grant colleges a department of mechanic arts is well organized, well manned, and should be recognized by this Association. I hold that it was the purpose of the act of 1862 to educate skilled artisans as well as scientific agriculturists.

The trend of capital is toward the towns. Of the great number of millionaires found by the last census, I suppose that nine out of ten live in towns. The tendency is toward the vast accumulation of wealth in the cities, and the trend of population in the same direction is equally strong. In 1790 it was estimated that the ratio of rural to urban population was 30 to 1; and now it is 4 to 1. You will all agree with me that a large part of the population of the towns live from hand to mouth. The mechanics, artisans, and skilled laborers constitute the explosive element of the country. It is easy to see that in the not distant future this will be a danger to republican institutions. I hold that it is the business and the bounden duty of this Association to make abundant provision for the education of mechanics and skilled artisans. Teach them their responsibilities, duties, and rights. How can that be done more effectually than by providing in the land-grant colleges for the liberal education of the industrial classes? I move you that a section of mechanic arts be provided for.

Mr. ALVORD. Mr. President, I hope that this motion will not prevail, and for this reason: In spite of repeated invitations to take part in this Association, the professors of mechanic arts instead of joining with us have endeavored to start an organization in a measure rival to this one. The constitution provides for additional sections, and if professors of mechanic arts come here and ask that a section be organized, it will certainly not be refused them; on the contrary, as past action shows, they will be heartily welcomed and granted the same courtesies and opportunities given to other specialists.

Mr. SCOTT. I desire to support the proposed amendment on the very ground on which the chairman of the executive committee has made his argument. We have just been exerting pressure on these institutions to bring representatives here, and certainly we should do more than to invite them. While I would not abate one jot or tittle of our interest in agriculture, I think the name that we bear is a misnomer, and we should follow as closely as we can the organic act which is for the benefit of agriculture and the mechanic arts. It may be that the gentlemen representing the mechanic arts feel hurt because we have given to agriculture an improper prominence. It certainly can do no harm and it may do good to adopt the suggestion of my friend from Kentucky.

Mr. DABNEY. I also desire to support the motion of President Patterson. I know from a conversation with the gentlemen who want to establish a section on the mechanic arts that they proposed to establish a separate association because they felt that they were not wanted here. I was somewhat disappointed and even pained to hear some gentlemen last evening express the opinion that the agricultural colleges were even in a measure a failure. I had hoped that our institutions had taken the broader view of the act of 1862, the view so admi-

rably expressed in the address of the president of this Association. I believe that as long as we take the narrow view that these institutions are nothing more than professional schools of agriculture we shall never satisfy the people. I am thoroughly convinced of this. The law did not intend to establish merely agricultural colleges. Our name is, therefore, a misnomer, and our constitution is one-sided. At the best, this constitution fails to represent properly two-thirds of our institutions. A large majority have mechanical departments, and a great many have extensive literary departments, including classics, modern languages, etc., which are in no way interested in the work of this Association. So we have been working with hardly one-half of the interests involved represented, and I sincerely believe that the time is coming when we shall make this Association influential throughout the country. How can we do that except by bringing in interests of every kind. Let us begin by bringing in men interested in engineering, later on those interested in other sciences, and, if possible, literary men, as work is provided in the classics and not merely economic science, There is no reason why in time we should not have sections of interest to men in all classes.

I would like to ask President Patterson to have this section include civil and mining engineering as well, because nearly all institutions have these departments.

Mr. HADLEY. I suggest that the motion should include a change in the name of the Association. Why not have it read American Colleges and Experiment Stations, or American Agricultural and Mechanical Colleges.

The PRESIDENT. Gentlemen should address themselves to the motion. The motion before the house is to insert in article 4 a fifth section devoted to mechanic arts.

Mr. HUNT. This is very interesting and I dislike to interfere in the general discussion, but a meeting of the section on agriculture is called for 10 o'clock, and at 10 o'clock I propose to move that we adjourn.

Mr. NEILSON. I think it is eminently proper that we should recognize the mechanic arts. The appropriations for the colleges are equally for agriculture and the mechanic arts, and it seems to me therefore but fair that we should recognize mechanic arts in this association.

Calls for the question.

Mr. DEPASS. What I wanted to say has already been said. Only this I will add, that the very caption is in my judgment wrong.

The PRESIDENT. I must confine you to the motion.

Mr. DEPASS. I wish only to call the attention of the Chair to the fact that I intend to make a motion on this question and will not detain the Association at this point.

The motion was carried.

Mr. WOODS. The hour for adjournment, in accordance with the rules, having arrived, I move you that we do now adjourn.

Mr. ALVORD. I simply wish to say that it will be impossible to bring this question before the convention again. I would cheerfully move to adjourn in ten minutes.

Mr. Woods withdrew his motion.

The PRESIDENT. If there is no objection we will pass on to the next, Article V.

The secretary read Article V.

V.—MEETINGS.

(1) This Association shall hold at least one meeting in every calendar year, to be designated as the annual convention of the Association. Special meetings may be held at other times upon the call of the executive committee, for purposes to be specified in the call.

(2) The annual convention of the Association shall comprise general sessions and meetings of the sections, and provision shall be made therefor in the program. The sections' meetings may be simultaneous or otherwise, at the discretion of the executive committee, but at least two sections of the Association, to be designated each year by the executive committee, shall present in general session of each convention a portion of the subjects coming before them.

The PRESIDENT. If there is no objection we will pass on to Article VI.

The secretary read Article VI.

VI.—OFFICERS.

(1) The general officers of this Association shall be a president, five vice-presidents, a bibliographer, and a secretary, who shall also be treasurer. The president, junior ex-president, the secretary, and four persons to be chosen by the Association shall constitute an executive committee, which shall elect its own chairman.

(2) Each section shall, by ballot, nominate to the Association in general session, for its action, a chairman and a secretary for such section.

(3) Officers shall be chosen by ballot at the annual convention of the Association, and shall hold office from the close of the convention at which they are elected until their successors shall be chosen.

(4) Any person being an accredited delegate to an annual meeting of the Association or an officer of an institution which is a member of the Association in full standing at the time of the election shall be eligible to office.

Several asked what would be the duties of the bibliographer.

Mr. ALVORD. He is to keep watch on the literary world in which this association is interested, and furnish bulletins calling attention to books or articles of interest to those connected with this association. We have an offer to publish these bulletins in the magazine, Agricultural Science.

Mr. TURNER. I wish to know whether the bibliographer is to be a salaried officer.

Mr. ALVORD. The officers of the association have equal salaries.

No changes were proposed to Articles VII, VIII, or IX, which were read in order.

Mr. DABNEY. I move that we reconsider the action by which the title was adopted.

The motion was carried.

Mr. DABNEY. I move that the name of the Association be changed so as to read The Association of American Agricultural and Mechanical Colleges and Experiment Stations.

Mr. SMART. I move to amend the proposed title to read The Association of National Colleges and Experiment Stations.

Mr. DEPASS. I move that we lay that amendment on the table.

Mr. SMART. I would like to say that it strikes me that National is a wiser term than American.

Mr. DEPASS. I withdraw my motion.

Mr. HADLEY. Does not national include all kinds of colleges organized under acts of Congress? Are they not national institutions?

Mr. DABNEY. Would this not include West Point and other colleges of that sort? They are all supported by appropriation.

Mr. ALVORD. I suppose this motion will pass, but I want to call attention to the fact that to change the name of a child when it is just becoming known is of no advantage to it. A single word more. This name was adopted after a full discussion. When you say agricultural college everybody knows what you mean. In the public journals the institutions here represented are known collectively as "agricultural colleges."

Mr. HADLEY. If the name is to be changed at all I do not like the term mechanical. Wherever I hear that term it seems to lack euphony. If the name be changed, I suggest Association of American Colleges of Agriculture and the Mechanic Arts.

Mr. SCOTT. I think that the closer we keep to the organic act the better. The act said "for the benefit of agriculture and the mechanic arts;" the whole system has been built up on that. We do not like the word mechanical. I certainly do not like the motion proposed that the colleges be called national. Our institutions are established under State authority. They are American, not national.

Mr. NEILSON. I agree with Dr. Scott. I think this question involves more than a mere name. We have had difficulties in New Jersey and I think probably throughout the country from misapprehension as to the scope of our work. I think the proposed change of name will have a good effect. It is not changing the name of the child, for all know it now by the proposed name.

Mr. Smart withdrew his motion.

Mr. SCOVELL. Mr. Chairman, I hope that the name will not be changed. I have a great deal of correspondence with colleges and treasurers of colleges and I have been advised by several that there would be no difficulty in getting dues if our name were shortened. I do not wish to inflict on my successor any more name to sign to vouch-

ers. Our Association is becoming known under this name, and I hope, for the sake of the Association and for the sake of members we have, that it will not be changed.

Mr. DABNEY. The motion is that the title shall read American Colleges of Agriculture and Mechanic Arts and Experiment Stations. I think the old name has caused much trouble and has retarded the progress and development of the college.

Mr. RYNERSON. I was in favor of the motion adopted providing for a section on mechanic arts, but I can not see any advantage to be derived from changing the name of the Association.

Mr. CAVITT. There seems to be something in the name of an institution. Why did Congress put "Agriculture and Mechanic Arts" in the bill? Was it not that both industries should be benefited? We represent mainly the agricultural department of these institutions, but I think we should be liberal enough to extend to the mechanic arts the honor of mention in the title. I am opposed to changing the name from American to National. I am a believer in reciprocity. Let us extend the hand of fellowship to South America, Central America, and Canada.

The motion was lost. Ayes 23, noes 37.

Mr. MYERS. I move that we now adopt the constitution as a whole.

Mr. ALVORD. I will ask unanimous consent for a verbal amendment. After the word agriculture in section 3, Article III, add the words, "Or mechanic arts," and the same in section 4.

The constitution was then adopted as a whole.

Mr. ALVORD. Carriages will be waiting for us at the St. Charles Hotel at 1 o'clock this afternoon to visit the Sugar Experiment Station at Audubon Park and the Southern University on the return trip.

Mr. Buchanan, representative of the Jefferson Club, was introduced, and stated that he was instructed to extend to the members of the convention the privileges of the club during their stay in the city. The invitation was accepted.

The convention adjourned at 10.40 a. m.

EVENING SESSION, NOVEMBER 16, 1892.

The meeting was called to order at 8 p. m.

The following resolutions were reported from the executive committee:

Resolved, That a committee of nine persons be appointed by the chair, to consist of members of governing boards of colleges and stations, to act as an advisory board in connection with the standing committees of this Association upon the coöperative exhibit of the colleges and stations at the World's Columbian Exposition.

Resolved, That the portions of the annual address to the Association by President Broun, which relate to the Exposition of 1893, be referred to this advisory board for its consideration and action.

The resolutions were adopted.

Mr. Neale, of Delaware, offered the following resolution.

Whereas this Association has received a request from the authorities of the World's Columbian Exposition to nominate four persons to be appointed members of the commitee to supervise the tests of dairy cows during the Exposition at Chicago; and whereas this is a subject of such importance as to require the most careful consideration, with a view to appropriate action: Therefore,

Resolved, That a committee of five be appointed by the Chair to consider this subject and to report to this convention the names of four persons suitable for members of the said testing committee, and to also report what further action is advisable in the premises.

Mr. Alvord explained that this resolution had already received the consideration and approval of the executive committee and that he was authorized to report it back to the Association for consideration in general session.

The resolution was adopted, and Messrs. Neale of Delaware, Atherton, Myers, Henry, and Gulley were appointed to consider the subject and nominate the supervising committee.

It was decided to reverse the order of the evening as printed and call first the discussion on Numbering Station Publications.

The PRESIDENT. The discussion of the evening was to have been opened by Director Harris, of the U. S. Department of Agriculture. As Director Harris is not present I will call the next speaker, Prof. Henry, of Wisconsin.

Mr. HENRY. This matter was brought before the executive committee, I believe, through letters asking whether station publications could not be made more uniform in numbering. I wish to direct attention to that point at this time. I need not tell you, who have to do with getting together the sheets from our stations, that they are very irregular in size; that, further, some are numbered regularly and that others are indicated by letters and numbers. This works serious detriment to persons trying to keep track of them. I think that if we could stop a moment we would get straight. The farmer don't care whether the bulletin he is getting is a special bulletin C or bulletin 713. He will throw away nine out of ten after reading. But when I have just received bulletin 93 and find I have already had bulletin X, I am in confusion. Has bulletin Z been issued? If so, where is bulletin A? I have a complete set up to 99. Shall I file lettered bulletins with them? Again, one station issues fractional bulletins. Now 17½ is received. Will 17¾ or 18 be the next one?

Now if we bear this point in mind I think it will be easy to solve the question. The farmer don't care about the number; the person keeping a file does care. Let us have this in mind when we do it. We want to have in the station library a history of the doings of our stations numbered consecutively. A simple numbering would have saved me perhaps a week's work, and in the next ten years perhaps two or three months' work trying to track out these sheets.

How shall we bind it? Why not issue bulletins in pamphlet form of the same size. Again, a number of bulletins have been exhausted and reprints made of them. One station has already republished five bulletins numbered for publishing a single bulletin. It has occurred to me that in Wisconsin we have failed to have the stations get bulletin No. 2. Why could we not, if we could not afford the expense of having type set up, have mimeograph copies made of them and send a copy to each of the stations? Of course it is better printed if we have the money. Now, we will help you in getting a set of the publications of our station.

I think, Mr. Chairman, it would be well to have a committee appointed to look over the subject pretty carefully in regard to this matter and make some report if possible. I feel that we are wasting too much time on small things, and to bring the matter before the Association I move that a committee of three be appointed by the chair. I see Director Harris is here and I will give up the floor.

Mr. HARRIS. It is not my purpose to enter into any extended discussion in regard to the publications of the experiment stations, but to confine myself to a narrow question in which it seems to me easy to work a great improvement without making great changes.

The Office of Experiment Stations is making elaborate and costly efforts to abstract, arrange, and index the publications of the stations. Much of this work for its highest value requires that the stations and many of the workers shall possess complete sets of station publications, and that these sets be so arranged that any publication and any place in any publication may be found readily, easily, and surely. Unfortunately peculiarities in the methods now used by the stations for naming and numbering publications make this extremely difficult. Two-thirds of the stations number their bulletins consecutively, using the natural numbers. The first bulletin published is numbered 1, and the twentieth, 20, the bulletin next before the twentieth, 19, and the one next after it, 21. This method has many advantages. For instance, when I take bulletin 20 of a station numbering in this way, I know that it has printed at least nineteen other bulletins. I know that these are earlier than this bulletin. I know that it has published only nineteen earlier than this bulletin. If I wish to refer to the tenth I need say bulletin 10 and no more.

These stations, as a rule, publish in addition to their bulletins an annual report, and it is customary for them to print one annual report in each and every year. Thus each year's publications consist of four or more bulletins and an annual report. One-third of the stations depart from this simple method. It will be sufficient to enumerate a few of the peculiarities. Some stations count the annual report as a bulletin. This raises the question, shall we say that the station has printed seven bulletins and an annual report, or six bulletins and an annual report, or seven bulletins and no annual report; or shall we

say, clumsily, as I suppose we must, that the station has printed seven bulletins of which one is the annual report? It is at least a cumbersome marking for a bound volume. Sometimes the annual report is printed as a part of the annual report of the board of agriculture of the State, and not printed separately. "Special" bulletins are in some cases lettered instead of being numbered, so that bulletin 20 is to be followed by bulletin Q, and the lists will read bulletins 11, 12, F, G, 13, H, I, 14, 15, 16, J, K, L, etc. This is bad enough at present, but what will happen when Z has been printed? Again, regular bulletins are both numbered and lettered, and we have 81*a*, 81*b*, and 82. Sometimes publications are arranged in volumes, the numbers beginning anew with each volume. Occasionally a bulletin is numbered with a fractional number. In only too many cases we have one or more series. Doubtless these peculiarities are often convenient to those who understand them, but to the caretakers in the many libraries in which these publications are preserved, to the students who use them and to bibliographers, that is, to all who care anything about the numbering of publications, these peculiarities must prove a weariness of the flesh. It seems to me that fairness to each other and to the public interest demands that we sacrifice personal and local convenience to the general good. In passing it is well to remember that to the farmer this question of numbering has little interest, his attention being confined to the contents of the bulletin.

In conclusion I wish to present the following resolutions which I will ask the secretary to read.

The Secretary read as follows:

Resolved, That it is the sense of this convention that, in so far as possible, the publications of the colleges and stations represented in this Association should be named, numbered, and dated according to an uniform method.

Resolved, That a committee of five be appointed by the chair to devise a system to be reported if possible to this convention for its action, or if not, to the executive committee, who shall then distribute copies of the plan to the institutions entitled to membership in the Association.

The PRESIDENT. Under the rules these resolutions will be referred to the executive committee.

Mr. NEILSON. I would like to say a word about the lettering of bulletins. Our station has been in the habit of lettering bulletins for this reason. For instance, a special interest is manifested in a bulletin. With us the cranberry interest has occasionally been the object of a bulletin. Now, we do not want to send to all a bulletin which affects the cranberry growers only. Now, if the bulletin is sent to cranberry growers only and it is regularly numbered, when the next bulletin is issued farmers from all over the state will begin to write asking why they were passed over in the distribution of that bulletin.

Mr. JOHNSON, of Wyoming. I favor this movement, and I want to speak of the method we have adopted in our station. Our bulletins are

numbered—our annual reports are not. When we print our bulletins, we lay aside a thousand copies for binding with the annual report at the end of the year. This binding together we find very convenient for reference and not costly, as the expense is only that of paper and presswork. I should like to see such a plan adopted by all the stations.

Mr. JOHNSON, of Connecticut. My station some time ago had occasion to issue a bulletin on the modification of the Kjeldahl method of determining nitrogen, of interest to chemists only. This bulletin was numbered in the regular order 112, and bulletin 113, one of general interest, contained a statement on the title page to the effect that bulletin 112 was of interest to agricultural chemists only and had been distributed among station workers alone. It was only necessary to issue a small edition of that bulletin, so that it was a great saving of expense.

There are some other points I wish to call attention to if in order. I have lost a good deal of time and have been worried and vexed in attempting to file the publications of the experiment stations. It is very important to my mind that each station should distinctly announce in print upon the bulletins the system which it follows in so far as it is peculiar. At the Connecticut station we issue our bulletins numbered consecutively from the beginning and ever since we have had funds to do it we have printed them in uniform octavo style. Some of our earlier bulletins were gotten up in any kind of shape that we could manage because we run the station three months without any funds and were always in arrears and always trying to accomplish a modest amount of work on a very, very limited amount of money so that our earlier bulletins were all sorts and sizes, some printed by sending the manuscript to an agricultural paper and getting proofs which were furnished us at the cost of press work. Any expedient to get material into shape and distribute it. Ever since we have been able to do so, since we have been getting $8,000 per year to work with, we print our bulletins in good shape, in a legible form and endeavor to make them pleasant to the eye. We have always followed the plan of printing an annual report and including in it everything worth publishing. Our bulletins may be lost. Notwithstanding, our annual reports contain everything worth preserving. It is of great advantage to us also in that it enables us to revise our work, to reëdit it and present it in its most attractive form. The stations ought to furnish every facility, so that the student can readily master the contents of publications. There should be an index of the bulletin on the front page, so that he may see at once what is of the most importance to him. If I get a bulletin of ten, fifteen, or twenty pages and have to spend ten or fifteen minutes in finding out what is in it, I am disposed to lay it aside and take it up when I have leisure, which I never have, and the contents of that bulletin pass, as far as I am concerned, into oblivion, and can only be rescued by the

valuable endeavors of the Office of Experiment Stations. If that furnishes me a suitable index of this literature I may make it available. The amount of matter published in this country and in foreign countries is so immense that without every facility placed at the disposal of the student it becomes simply impossible to keep track of them. It is of the utmost importance that every single paper have a special table of contents, unless matter of simple sort, for without that it is difficult to take advantage of the information, however valuable, which is published.

Mr. REDDING. I rise to insist upon some of the changes in numbering bulletins which I have offered. I have adopted the plan of filing away not less than two hundred copies of each bulletin. So far I have included two years in one volume for the reason that the publications have not been voluminous. At the end of this period I have an index prepared to the volume and sent to the printer for binding. I send a copy to the director of each station, and, I think, to each college also. I find that it is of great advantage to me to have the bulletins bound in that way, and I believe it would be to others. I would be glad indeed if I could get bound volumes of the publications of each station. It seems to me that the stations would appreciate the work of other stations better in that form.

Now another point. In order to prevent our correspondents from calling for bulletins which we did not intend them to have I used the simple expedient of half numbers. A special bulletin I called 17½. If a man gets 17½ he knows it is intended for him to read. Now, my next bulletin is 18. Now, when the farmer gets 18 he will not know that such a bulletin as 17½ was issued. On the other hand, I issued a bulletin intended for the farmer only. It is not on any subject of investigation, but simply a notice to farmers, informing them of the organization of the station and other matters not of importance to other stations. I called that 12½. Perhaps some of the stations got that bulletin. I got no requests for 12½ and few for 17½. I think that solved the question without any difficulty at all.

There was one other question that troubled me. I wrote to Maj. Alvord as to what matter should be included in the annual report of the station. If you will read the law closely you will probably understand it as I did. It was not the intention of the law that we should make a detailed statement of the results of experiments in the annual reports. It requires that we should send so many copies to the Secretary of the Treasury and one copy to each of the stations. It makes no provision for sending them to farmers at all.

Mr. HARRIS. May I ask a question of the last speaker? Director Redding is one of the most exact and systematic of men, and if we all kept records as he does any system would work. But this bulletin—17½—does it have any relation to 17?

Mr. REDDING. None whatever.

Mr. HARRIS. There is the danger. Suppose you have a second edition of 17½, with some additional matter, what would you call it?

Mr. REDDING. I would call it "17½, second edition, revised and corrected."

Mr. HARRIS. We know that if Director Redding is going to send out bulletin 17½ we will get it. But you will remember that there came a time in Egypt when they knew not Joseph, and there will come a time when we know not Redding, and I venture to say that that man will not send out 17½. Now, how do we know that we will get 48½?

Mr. REDDING. The bound volumes will contain every bulletin issued by the station.

Mr. HARRIS. How often do you issue that bound volume?

Mr. REDDING. It is issued every two years. Our bulletins are fourteen or fifteen in number, of twenty-eight or thirty pages each, and it was for my own convenience that I put two years together. But, if this association thinks it desirable to have bulletins for a year bound together, I will gladly make the change.

The PRESIDENT. There was a resolution passed at an earlier session of this convention by which the chair should appoint a committee of nine persons to act as an advisory committee to the standing committees on the coöperative college and station exhibits at the World's Columbian Exposition, consisting of members of the governing board of colleges and stations. I will appoint on that committee Messrs. Henry Chamberlain, of Michigan; W. R. Cavitt, of Texas; James A. Beaver, of Pennsylvania; H. B. Dale, of Wisconsin; Hart Gibson, of Kentucky; R. H. Warder, of Ohio; Daniel Needham, of Massachusetts; William L. Rynerson, of New Mexico; and John Cameron, of Mississippi.

Another resolution requiring the appointment of a committee by the chair was for supervising dairy tests at the Chicago Exposition. I will appoint as a committee for nominating four persons suitable for members of this committee Messrs. Neale of Delaware, Atherton, Myers, Henry, and Gulley.

Mr. HENRY. I do not think that the stations ought to feel that any bulletin ought not to go into the libraries of other stations. If you issue a bulletin to farmers, giving information in regard to your stations, that is a part of the station work and other stations should have that to bind up in the history of the work of your station. I do not think that kind of a fellow feeling ought to exist. Then, again, by inserting a paragraph on the title-page of the bulletin informing the farmer readers that the previous bulletin was not for general distribution, but could be obtained on application, you would be able to number bulletins uniformly and save all trouble.

Mr. SCOTT. Gentlemen of the association, President Broun has been called away and has asked me to take the chair.

Mr. Fairchild. I wish to emphasize what Dr. Johnson has said in regard to the contents of bulletins. I hope the committee will take into consideration especially the whole matter of title-paging, showing the contents of bulletins in addition to consecutive numbering. It seems to me we ought to be able at a glance to tell what a bulletin contains.

We have, I am sorry to say, followed two methods in issuing our bulletins, but not with reference to numbering. We have numbered them consecutively from the beginning. We did attempt for the first two years to republish all important matter for preservation in an annual volume, but we found that a very expensive way of presenting to the public what we thought important for them to have. We have therefore adopted the plan of inserting a notice in each bulletin that the bulletins for that year, beginning with number so and so, will be indexed in the annual report for that year. We also reserve a thousand copies for binding ourselves, and if any station worker desires a bound volume we shall be glad to furnish it.

I should like to present to that committee, when appointed, a title-page of one of our bulletins, to see if there are any suggestions in that which they can adopt.

Mr. Hadley. I have been extremely interested in this discussion and I like very much the remark of President Fairchild that the matter of title-paging should be taken under consideration by the committee.

There is one other point I would like the committee to consider: The best method of handling these bulletins after we get them. We are getting bulletins from nearly 50 stations. What is the best method of filing these while unbound. The matter of indexing, as Mr. Fairchild has spoken of, on the outside page is a matter of very great importance, but I think, however, it is generally adopted at the stations. I think most bulletins have an index on the front page. I had the honor of making a motion to that effect two years ago at Champaign. I think, however, it should be considered by this committee.

Mr. Clute. In making up our publications for binding I have observed a difference in size. If we could adopt a uniform size for a page, print on a page so many inches wide and so much margin, then one could bind these publications into a volume and they would appear more orderly and systematic on our library shelves than where of different sizes. It would be very easy for the stations to adopt a uniform size if the committee would recommend it.

I had my clerk make out a list of all the duplicates we had and forward that list to each of the stations with the statement that we would furnish these numbers to those applying for them as long as they lasted, and I am glad to say we furnished a good many to stations. I want to acknowledge the kindness of these stations in sending to me missing numbers asked for.

Mr. ROBERTS. The difficulty in getting the bulletins uniform in size rests in the fact that many annual reports and bulletins are published by the State printer, and you might as well try to move the earth as to change a State printer or his methods. Those stations like Cornell, who print their own bulletins, can easily change, do what they please, but I know in the case of our State station their bulletins are a different size from ours, and we can't get them to change. This is a very great inconvenience to us in binding our annual reports and bulletins.

I trust that the committee will see that there are no more half numbers and no more A, B, and C bulletins, if that can be done without seriously discommoding the stations.

The PRESIDING OFFICER. Is there further discussion? If not the chairman of the executive committee will make a report.

Mr. ALVORD. The resolution seems to embody what is desired and I therefore report it back to the Association with the suggestion that it now pass. Before reading let me add a word. It seems to me that if all the stations would evince the same spirit as the Georgia station, simply say that whatever the Association agrees to the station will do, the question would be easily solved. The resolution, as given above, as offered by Mr. Harris, was again read, and adopted.

The PRESIDING OFFICER. I will appoint on that committee Director Harris, of the United States Department of Agriculture, Directors Johnson, of Connecticut, Johnson, of Wyoming, Henry, of Wisconsin, and Redding, of Georgia.

The PRESIDING OFFICER. Is there any further business?

Mr. ALVORD. The regular order is the consideration of subjects coming from the botanical section.

The PRESIDING OFFICER. We will take the regular order then. The first thing in order is a paper on the treatment of apple scab by Prof. Goff, of Wisconsin. Ten minutes to present paper.

Mr. Goff then read the following paper on the "Treatment of Apple Scab."

NOTES ON THE TREATMENT OF APPLE SCAB.

During the past seven years the writer has made applications intended to prevent damages from the disease known as apple scab, due to a fungous parasite known to science as *Fusicladium dendriticum* Fck. So long a period of experiment appears to warrant certain conclusions that might have been very unsafe from one or two seasons' experiments. It is not my purpose to present here a statistical report of these experiments, but simply to mention briefly some of the facts that seem clearly brought out. Of many materials tried the copper compounds have proved most efficacious. The carbonate of copper, used in suspension in water and also dissolved in ammonia, the arsenite of copper, or Paris green, applied in suspension, and the sulphate of copper applied in compound with lime, as in Bordeaux mixture, have all proved efficacious in certain seasons, but the degree of their relative efficiency has been far from uniform, a result that seemed rather difficult of explanation until the experience of the past season. A comparison of the meteoro-

logical conditions of the different seasons in which these copper compounds have been tested, with the results secured, taken in combination with observations upon the length of time the different compounds have remained upon the foliage, appears to warrant the general conclusion that the three copper compounds named, viz, carbonate of copper, Paris green, and sulphate of copper combined with lime, are efficacious in preventing damage from the apple scab nearly in proportion to the length of time that they remain upon the foliage. In the summer of 1891, in which very little rain fell in central Wisconsin after the middle of June, Paris green applied in suspension with lime proved even more efficacious than either the Bordeaux mixture or the carbonate of copper. The past season, when the month of June was exceptionally rainy, and spraying had to be performed between showers, the Bordeaux mixture proved decidedly more efficacious than either Paris green or the ammoniacal carbonate of copper. The reason for these variable results appeared to be in the great adhesiveness of the Bordeaux mixture to the foliage. In every case where this compound has been used, though it has not been applied later than the middle of July, it has remained visible upon the foliage throughout the season, and the effect of the applications made in July, 1891, were still distinctly visible upon the branches and trunks of the trees to which it was applied in October, 1892, fifteen months after the application. It thus appears that the adhesiveness of this fungicide is so great that it can be depended upon to hold its place even through abundant rains.

I may add that this compound appears to be as efficacious when used at half the strength of the original formula, *i. e.*, when 3 pounds of copper sulphate and 2 of lime are used in 22 gallons of water, as when made of double this strength.

From what has been said, it is clear that the Bordeaux mixture must be regarded as the only fungicide thus far tested that can be recommended with confidence to prove effectual against the apple scab, although under favorable circumstances either the carbonate of copper or Paris green appears to possess equal fungicide properties. Unfortunately, this compound has the objections of being somewhat difficult to spray, of requiring more or less stirring to keep it in suspension, and of losing its efficacy as a fungicide if not used promptly after it is prepared, but until we can find a preparation that is equally adhesive to the foliage and has fewer objections, we can do no better than to employ it.

Our experiments indicate that it is important to make the first spraying before the opening of the flowers. The number of applications it is necessary to make to accomplish the best results is yet to be determined. In Wisconsin the weather during and after midsummer is apt to be rather dry, and hence sprayings after July 1 are of rather doubtful value.

I may add in conclusion that a fertile soil and frequent breaking up of the orchard are found to greatly reduce the damage from apple scab, and also that certain varieties appear to possess a decided resistant power to this disease. While the use of the spray pump in the orchard will doubtless, in the long run, prove eminently profitable both in the quality and quantity of the fruit it will enable us to secure, the wise orchardist will supplement it with plant food and cultivation, as well as by the selection of varieties that experience has shown are well able to cope with this destructive enemy of our apple trees.

The PRESIDING OFFICER. Are there any remarks on the paper? If not in the regular order we will have a paper by L. R. Jones, of Vermont, on the "Comparative tests of fungicides in checking potato blight and rot."

Mr. TRACY. In the absence of Mr. Jones I have been requested to read his paper.

A Comparative Test of Fungicides in Checking Potato Blight and Rot.

This is the fourth year in which Bordeaux mixture has been used at the Vermont Station in checking the ravages of *Phytophthora infestans*. This work has been uniformly successful. Probably every one who uses this mixture, however, wishes that a cheaper and more conveniet substitute could be found. Such substitutes have been used in work upon grape and orchard diseases. In fighting this potato disease, however, we have to meet not only a different fungus, but also somewhat different conditions of development. *Phytophthora* differs most strongly from most of the orchard and vine fungi in that it does not begin its attack at the beginning of the season and spread slowly, but instead gives no external sign of its presence until the latter part of the summer. At this time, when the plants reach proper maturity, and suitable conditions of heat and moisture prevail, the rapidity of the development and spread of the disease is something almost incomprehensible to one who has not witnessed it. Your attention is called especially to these facts as explaining in part the surprisingly poor results obtained from the use of certain fungicides which in the vineyard and orchard work have gained a good reputation.

In the summer of 1891 we undertook experiments to test the comparative value of, (1) ammoniacal copper carbonate; (2) glue mixture; (3) Bordeaux mixture, half strength; (4) Bordeaux mixture, full strength. The results as reported in the publications of the Vermont Station were decidedly in favor of the Bordeaux mixture, and showed the ammoniacal solution and the glue mixture to be of little value, under the conditions of that experiment. We felt, however, that the conditions might not be such as to give these remedies a fair trial, although it was evident that they were inferior to Bordeaux mixture.

This summer (1892) a comparative test was made of twelve of those fungicides which appeared most hopeful. The work was carried on in two different fields, one a clay loam, the other a lighter, rather sandy soil; the plots were so arranged that all the fungicides were given a trial on both medium and on late potatoes; five standard varieties of potatoes were included in the experiment, and in all plots the relative value of two and of three applications was tested.

Following is a list of the fungicides tested:

First: Copper soda solution: Copper sulphate, 13.3 ounces; sal soda 20 ounces; water, 5 gallons.

Second: Copper acetate solution: Copper acetate (verdigris), 8 ounces; water, 5 gallons.

Third: Bordeaux mixture and molasses (copper-lime saccharate): Copper sulphate, 13.3 ounces; lime, 13.3 ounces; molasses, 13.3 ounces; water, 5 gallons.

Fourth: Ammoniacal copper carbonate: Copper carbonate, .55 ounces; aqua ammonia, one-third of a pint; water, 5 gallons.

Fifth: Bordeaux mixture, full strenth: Copper sulphate, 1½ pounds; lime, eight-ninths of a pound; water, 5 gallons.

Sixth: Bordeaux mixture, "5-5—50," formula: Copper sulphate, 8 ounces; lime, 8 ounces; water, 5 gallons.

Seventh: Bordeaux mixture, very weak (about one-eighth strength): Copper sulphate, 2.6 ounces; lime, 2.6 ounces; water, 5 gallons.

Eighth: Copper and ammonium carbonate mixture (Dr. Chester's formula): Copper carbonate, 1.06 ounces; ammonium carbonate, 3.2 ounces; water, 5 gallons.

Ninth: Glue mixture (Dr. Galloway's formula): Copper sulphate, 2 ounces; sal soda, 2.4 ounces; Le Page's liquid glue, 1.6 ounces; water, 5 gallons.

Tenth: Modified Eau Celeste: Copper sulphate, 7 ounces; sal soda, 9 ounces; aqua ammonia, one-third of a pint; water, 5 gallons.

Eleventh: Copper carbonate in suspension: Copper carbonate, 5 ounces; water, 5 gallons.

Twelfth: Copper chloride solution (Cornell Station formula): Copper chloride 0.66 ounces; water, 5 gallons.

Each year of work upon this potato disease leads me to appreciate more strongly the fact that the greatest value of the fungicide is not in protecting the tubers from the rot, but rather in preserving the foliage from the blight. When the foliage is thus preserved the tubers come to full size and maturity, and the gain in yield, from prolonging the life of the vines three or four weeks in the fall, is very great. Such being the case, the relative values of the fungicides can be better judged from the appearance of the foliage of the treated plants than from the yields. On the other hand, the absolute gain from the use of any fungicide must, of course, be judged by the increased yield of tubers resulting from its use. I, therefore, send some photographs with this paper, which will enable you to judge of the relative values of the fungicides better than any array of figures stating the varying yields. The full yields will be published later, and I will now select from the figures before me only enough to enable you to judge of the absolute gain from the use of some of the better fungicides. There were two rows of potatoes in each plot in the field shown in the photographs. Two of the photographs (the 8 by 10's) show some of the plots as they appeared September 10. These show clearly the effects of both Bordeaux mixture (plot 7) and weak Bordeaux and molasses (plot 4). No less interesting will be the appearance of plot 5 (ammoniacal copper carbonate), as shown in one of these photographs. It was found impossible to bring out with equal clearness the less marked differences between most of the plots by photographs, and, therefore, instead of attempting to include the entire plot in the photograph, an average hill was photographed from each plot. This explanation will, I trust, be sufficient to enable each who chooses to examine the photograph to do so understandingly.

The gain from spraying this year was unusually marked, owing to the prevalence of the disease. This can be judged from the following statements of yield of those plots shown in the 8 by 10 photographs:

	Bushels per acre.
Plot 4 (weak Bordeaux mixture and molasses) at rate of	330
Plot 5, ammoniacal copper carbonate	99
Plot 6, untreated	97
Plot 7, strong Bordeaux mixture	246.5

These experiments, supported also by data of last season's work, lead me to the following conclusion as to the relative values of the fugicides for the potato blight:

(1) Copper soda solution (plot 2) has merits, but is not at all equal to Bordeaux mixture.

(2) Copper acetate solution (plot 3), a fairly good fungicide, but so injurious to the foliage as to exclude its general use.

(3) Weak Bordeaux mixture and molasses (plot 4). Good results. Probably more valuable than same without the molasses.

(4) Ammoniacal copper carbonate (plot 5). Unquestionably the weakest fungicide tested, being but little better than nothing. (I should feel less confident in this verdict did not all the results agree so perfectly in all my experiments. I am convinced that I do not underestimate its value for this work).

(5) Strong Bordeaux mixture (plot 7) leaves but little to be desired in the results obtained.

(6) Weaker Bordeaux mixtures (plots 8 and 9) were not equal to full strength Bordeaux mixtures, as can be seen from following yields:

(Field A was of medium early potatoes, which blighted badly when not protected. Field B was of late potatoes and on lighter soil, hence not so badly diseased.)

[Bushels per acre.]

	Plot 6 (untreated).	Plot 7 (strong Bordeaux mixture).	Plot 8 (Bordeaux mixture, 5-5-50).	Plot 9 (Bordeaux mixture one-eighth strength).	Plot 11 (untreated).
Field A	97	246½	155	145	119
Field B	108½	189½	177	122	91½

Owing to certain conditions of soil I think the above figures in Field A would underrate the value of Bordeaux mixture "5-5-50" formula, but I am convinced that this formula does not give as good protection as does the strong Bordeaux mixture. While the very weak Bordeaux mixture had greater fungicidal value than many others tried it did not have enough to recommend it for general use.

(7) Copper and ammonium carbonate mixture (plot 10) was of some value, but not enough to be recommended for general use.

(8) Glue mixture (plot 12) ditto.

(9) Modified eau celeste (plot 13) gave best results of any of the soluble fungicides, and although not equal to either of the stronger forms of Bordeaux mixture it is the best thing to recommend where a soluble fungicide is desired.

(10) Copper carbonate in suspension (plot 14), of considerable fungicidal value, though not enough to recommend its practical use.

(11) Copper chloride (plot 15), of still less value than the last.

I would therefore rank them as follows in order of fungicidal value:

1. Bordeaux mixture, full strength.
2. Weaker Bordeaux mixture and molasses.
3. Bordeaux mixture, "5-5-50" formula.
4. Modified eau celeste.
5. Copper soda solution.
6. Verdigris solution.
7. Bordeaux mixture, very weak solution (one-eighth strength).
8. Copper carbonate in suspension.
9. Copper and ammonium carbonate mixture.
10. Glue mixture.
11. Copper chloride solution.
12. Ammoniacal copper carbonate.

The first four did good enough work, so that I feel justified in recommending them for use by practical potato-growers. The others are none of them to be recommended, in my judgment.

Bordeaux mixture in some of its forms remains, then, as the most valuable fungicide of this work. The addition of a cheap molasses to the weaker mixture appears to increase its value by rendering it more adhesive.

The PRESIDENT. You have heard the paper read by Mr. Tracy; is there are any discussion on it? If not, we will take up the next paper, "A Study of Fruit Decays," by Byron D. Halsted, of New Jersey.

Mr. Halsted presented the following:

A STUDY OF FRUIT DECAYS.

The speaker's attention was called to the subject of fruit decays by a quince-grower, who complained of a destructive rot in his orchard. Upon investigating the trouble a decay was found that was due to a fungus of the genus *Sphæropsis*. The same orchard contained apple trees, with decayed fruit, and also pears. The apple decay was due to *Sphæropsis malorum* Pk. Circumstances aroused the suspicion that the quince decay was caused by the same species of fungus. Cultures and inoculations were next instituted in the laboratory, and it was proved that the Sphæropsis of the apple would grow upon the quince, and that the quince upon the apple. In like manner the same relation was established between the quince and apple Sphæropsis, and the one upon the pear. In short, the three fungi are probably the same, and in the complete eradication of the one, the others need to be destroyed, or else the trouble will spread from one kind of fruit to another. A worthless overburdened apple tree may, through neglect, shorten the crop of quinces by being a propagation bed of decay.

A systematic study of the probable relationship of the anthracnoses of fruits was led up to by the above investigation. Under the term anthracnoses are included the members of the two nearly related genera, *Glœosporium* and *Colletotrichum*.

They differ from each other somewhat in general appearance, but chiefly by the presence of stiff dark hairs in the spore spots in the colletotrichums—they being absent in the glœosporiums. A very large number of species have been established in each genera and the list is increasing yearly. Many kinds of fruit are attacked by them, as well as other parts of plants.

The laboratory experiments consisted chiefly in transferring the virus from an affected fruit to one in health. The common apple ripe rot, or "bitter rot," is a familiar example of the anthracnoses, and bears the botanical name *Glœosporium fructigenum* Berk. Spores of this were transferred to several other kinds of fruit with success, thus producing artificially the disease similar to that of the apple. Previous to this series of experiments the Division of Vegetable Pathology at Washington had shown that this "bitter rot" of the apple was the same as a certain decay of the grape fruit.

At this point in the treatment of the results a chart was shown by means of which the facts established were presented in a graphic manner. The following fifteen fruits, representing widely different orders of plants, were represented as arranged around an oval, as follows: Apple, peach, banana, pepper, bean, persimmon, lemon, watermelon, quince, citron, grape, tomato, eggplant, pear, and squash. The successful inoculations from any fruit to another were shown by lines and arrows, the lines being in fact the arrows. Thus, if the fungus was a *Glœosporium* a dotted line was employed, and if a *Colletotrichum* a solid line was used. The apple has native to it a glœosporium as above mentioned. The chart showed dotted lines running from the apple to the peach, banana, pepper, bean, persimmon, lemon, quince, grape, tomato, eggplant, and pear; in fact, to all that were inoculated. The pepper has a *Glœosporium* (*G. piperatum* E. & E.) This was successfully taken to the apple, as also to the grape, and to the banana, bean, persimmon, and pear. This is strong evidence that either *G. fructigenum* Berk and *G. piperatum* E. & E., have both a much wider range of hosts than supposed, or else are the same fungus. The differences in size of spores and filaments do not warrant specific distinction. In like manner the tomato has a species, *Glœosporium fomoides*, Sacc. recorded upon it. This was easily taken to the apple, banana, bean, grape, eggplant, and pear, thus suggesting that this is the same as the one with which the experiments started on the apple.

It is not necessary to go further, the chief point of the paper being, first, that the anthracnoses of fruits are probably fewer in species than supposed, and a few may cause all the damage attributed to many. This closer relationship of these decays suggests the still greater importance of not letting one decaying fruit serve to propagate the disease for another. Lastly, the graphic method of showing the whole work of inoculation at a glance was offered as possibly useful for illustrating other similar results of laboratory investigations.

The PRESIDENT. Is there any discussion on the paper? If not, the next is a paper on breeding of fruits, by N. E. Hansen, of Iowa.

In absence of Mr. Hansen, the following paper was read by Mr. Pammel, of Iowa:

NOTES ON THE BREEDING OF FRUITS.

This subject is one of great practical importance to the Northwest. The wonderful results attained by crossing and hybridizing in improving our flowers, grapes, and some of the small fruits, lead us to expect that similar results can be achieved with the orchard fruits. Comparatively little work has been done in this line, because results are not so speedy, and we have been satisfied with chance seedlings, allowing insects and the wind to do most of the work for us. But the peculiar and severe climate of the Northwest requires that we should endeavor to originate new varieties better adapted to this vast region. The indiscriminate sowing of seeds is an expensive lottery. Breeders of animals select the parents;

why should not breeders of fruits do the same? I regard crossing and hybridizing as a method of abridging the process of evolution by introducing new elements of variation. The primitive types peculiar to each region should be used, if necessary, for one side of the cross, to impart hardiness, because they have as a rule become fully adapted to their environments by ages of natural selection, resulting in the "survival of the fittest." The theory we generally follow is that the pistillate parent is more apt to transmit hardiness, and the staminate parent size and quality of fruit.

Extensive series of experiments in this line were inaugurated at the Iowa Agricultural College in 1886 by Prof. J. L. Budd, and have been continued up to the present time. The results so far are very promising.

It may be of interest at this time to note some of the results of our work and the most promising lines of work in improving our fruits.

In bulletin No. 14 of the Iowa Experiment Station, Prof. J. L. Budd gives a summary of results attained in breeding orchard fruits. It is shown that seedlings obtained from crossing Russian apples, or from crossing Russian with American apples, are much superior in leaf, tree and habit of growth to seedlings of purely American apples, descendants of west European varieties. The same relative superiority was noticeable the past season. The seedlings in leaf, bud, habit of growth and hardiness follow the mother, and the few specimens of fruit obtained to date show modifications due to the male parent. It is evident so far that these seedling apples, of partly or wholly Russian parentage, inherit the scab-proof characteristic of the Russian race of apples (see Bulletin 18 Iowa Experiment Station) and we hope that among them will be found desirable additions to the fruit lists for our northwestern prairies. The aim of the work has been to secure iron-clad varieties of high quality for all seasons, and the work will be continued.

In crossing pears the object has been to cross the hardiest of the east European varieties with those of the highest quality of west European parentage.

In crossing cherries, the aim has been to cross the hardiest sour cherries from east Europe with the best sweet varieties, also to improve the native *Prunus pumila* and *P. pennsylvanica*. In the present year we failed in our work with the two latter species, but the work is not abandoned.

In improving our native plums the object has been to obtain high quality by using as the staminate parents the best European and Japan plums. If the cross proves so violent as to affect injuriously the productiveness and hardiness, the same method will be followed as in improving the grape, viz: to use the pollen of these hybrid varieties on our wild plums, thus securing a smaller infusion of foreign blood.

Some seedlings of De Soto crossed with a large blue plum grown in Oregon, show important modifications in foliage and fruit, and are of interest in this connection.

In the work of improving our cultivated grapes the aim has been chiefly to use Worden as the best member of the Concord family, for earliness, hardiness, and productiveness, and to use varieties of partly *Vitis vinifera* parentage to obtain high quality. This is because the history of Rogers' and other hybrid grapes show that to use a variety of purely European blood makes the cross too violent for the best results as to hardiness and productiveness, and it is hoped that better results will be obtained by using a smaller proportion of foreign blood. Hence Worden and other early Concord seedlings have been crossed with Agawam, Salem, and other Rogers' hybrids.

The same method should be followed in improving our wild grape. The Northwest greatly needs a grape of good quality that is early enough to ripen even in North Dakota and Minnesota, and is perfectly hardy without winter protection.

The past season our wild grape has been crossed with Empire State to determine the effect of using a variety considered to be of purely native parentage. Worden has also been crossed with our wild grape.

In crossing grapes I found that the caps and stamens could be removed with much facility by using the tips of the fingers as well as the pinchers. Also that pollenizing could be performed to good advantage by taking clusters of bloom just opened and fastening them with string and fine wire in close proximity to the emasculated clusters. This is much easier than gathering the pollen and applying it with a camel's hair brush. Paper sacks were used until the grapes were well set, then mosquito netting.

Our native hazelnuts, walnuts, hickorynuts, and chestnuts, all merit our careful attention, as they are no doubt capable of vast improvement by crossing and selection. Especially promising is our wild hazelnut, as it probably would soon rival the best filberts.

Our native gooseberries crossed with some large English varieties would likely yield valuable results. The past season we have crossed a hardy gooseberry from the Amur Valley in Asia with the Industry. The object is to obtain a hardy, mildew-proof variety with fruit rivaling in size and quality the best English gooseberries.

The Northwest needs a good variety of raspberry hardy enough to bear well at the North without winter protection. With this end in view, we have this season crossed a wild red raspberry from the Black Hills with the Shaffer's raspberry.

Similar work remains to be done with our indigenous currants, juneberries, blackberries, dewberries, strawberries, and other fruits. This may well be termed fundamental work in horticulture, and deserves the most careful attention of our experiment stations.

While not properly coming within the scope of this paper it may in conclusion be of interest to note that we are endeavoring to originate a new race of hardy double roses. Several varieties of *Rosa rugosa*, imported from Russia by the Iowa Agricultural College, have proven perfectly hardy without winter protection, have large fragrant flowers and are perpetual bloomers, but the flowers are single. The past season we have crossed them with a member of choice double roses, such as General Jaqueminot, American Beauty, Magna Charta, Madam Masson and Triumph de Exposition, and now have fully 20,000 seeds put away for spring planting. Some work has also been done with other primitive species, including our native *Rosa blanda*.

The PRESIDENT. You have heard the paper of Mr. Hansen; is there any discussion on it? If not we will proceed. The last paper of the evening is "The Crossing of Cucurbits" by Prof. Pammel, of Iowa.

Mr. Pammel then read the following paper:

THE CROSSING OF CUCURBITS.

In 1891 the writer read a paper * before one of the horticultural societies in Iowa in which the statement was made that melons and cucumbers do not mix, nor do pumpkins and melons. He was vigorously assailed by horticulturists for teaching doctrines which were heretical. Many claimed to have observed from actual experience that they do "mix." Nearly every one with whom the writer conversed had one opinion in this matter; that they would cross. I have not endeavored to get the opinion of seedsmen on the point. In conversing with Prof. Barrows, who has had considerable experience, I am informed that he has never known them to "mix." My brother, who grows many cucurbits, believes that pumpkins and squashes and cucumbers and melons will mix.

To settle this matter, so far as the writer was concerned, a series of experiments were undertaken. In this paper nothing more than some preliminary statements can be made, inasmuch as it will be necessary to grow the cucurbits another year

* The effects of cross-fertilization in plants. A paper read before the Northern Iowa Horticultural Society, December, 1891.

before conclusions can be reached. This paper must be considered as supplementing the excellent work of Naudin,* Bailey,† Sargent,‡ and others. To Naudin belongs the credit of having thrown much light on the subject of *Cucurbitaceæ*. During many years he experimented with a large number of varieties from different places. He found that the species did not "mix," and that when hybrids were produced they yielded either no seed or sterile seed.

Bailey remarks: "Many careful hand pollinations have been made between these two classes of fruits (*C. maxima* and *C. pepo*) and in no case have seeds been procured. Sometimes the fruit will develop for a time, and in two or three instances a summer crookneck pollinated by a turban squash has developed till half grown and has persisted until the end of the season, but it was seedless. All our experiments show that *Cucurbita pepo* and *C. maxima* do not hybridize." M. M. Vilmorin-Andrieux § says: "And we may remark that we do not know any form of gourd that should necessarily be considered a hybrid between any two of these species." But Thomas C. Gentry‖ speaking about hybrids between *C. pepo* and *C. ovifera* says: "Here it is evident, is a case of hybridism brought about through the agency of bees, whereby a cross between two closely allied species has been effected in an eminently successful manner, if the size, quality and profusion of the fruit are any criterion."

To insure if possible a perfect intermingling varieties of the following melons, cucumbers, pumpkins and squash were planted: *Citrullus vulgaris*, *Cucumis melo*, *Cucurbita maxima*, *Cucumis sativus*, *Cucurbita pepo*, gherkin, and dipper gourd.

This plan gave excellent facilities for the varieties of *Cucurbita pepo*, *C. maxima*, *Citrullus vulgaris*, *Cucumis sativus*, and *C. melo* to grow together. This was done to test the point frequently made by many that watermelons taste like pumpkins when growing close to them. I was also told that hand pollination would not give as good results as the natural method. But there is by no means unanimity on this point by growers of melons. Some believe the effect is seen the first year, while others believe that it can only be detected the second year.

Our experiment was unfavorable in some respects, due to a late season and the destruction of most of the melons by boys, but such as remained showed no traces of pumpkin. The Perfection Gem (*Citrullus vulgaris*) grew right among the pumpkin vines, Sweet Sugar pumpkin and Perfect Gem squash (*Cucurbita pepo*), and the two species tested were considered excellent, with no foreign taste. Montreal Improved (*Cucumis melo*) growing in with the vines of Sweet Sugar pumpkins (*Cucurbita pepo*) had an excellent flavor.

So far as the work has been carried out two questions only can be discussed: (1) Immediate effects of crossing; (2) prepotency of pollen. In all of the varieties grown in the field, while fertilization was affected by insects, no immediate effects were observed. But some of the varieties showed great variability, especially of *Cucurbita pepo* and *C. maxima*.

In the nest-egg gourd (*C. pepo*) many had of course the shape of an egg of a dirty white color. Others were flattened on the "blossom" and "peduncular" end, with the greatest circumference in the middle of a transverse section. Others were mottled with green and white, elongated in shape, narrow at the "peduncular" and "blossom" end. In the Perfect Gem, also, great variability was found. Some specimens were two or three times the normal size, flattened at the "blossom" and "peduncular" ends, having the greatest circumference in the middle of a transverse section. Still others were barrel shaped. Still others were more or less conical at the "blossom" end. In the Long Warted, some resembled the pumpkin, showing no warts; some were shaped like a crookneck, but without warts. In the Vegeta-

* Annales des Sc. Nat. Bot., 4th series, Vol. VI, 1856, p. 5.

† Third annual report of the Cornell University Exp. Sta., 1890, p. 180.

‡ Memoirs sur les cucurbitacees, 1826.

§ The Vegetable Garden, p. 251.

‖ American Naturalist.

ble Marrow (*Cucurbita maxima*) some were marked with green and yellow and some almost entirely green, others a creamy yellow. In all of the cases, these peculiarities or deviations were traced to plants arising from distinct seeds and in no case were any immediate effects of crossing observed. About four hundred hand pollinations were made by the assistant, Mr. Stewart, and myself, assisted by two students, Messrs. Brown and Carver. Out of these quite a number set and produced perfect fruit. Only a few will be recorded here.

Common pumpkin on Perfect Gem (*Cucurbita pepo*) no indication of the common pumpkin. Nest-egg gourd (*Cucurbita pepo*) on Perfect Gem, no indication of gourd. Two specimens of common pumpkin on Long Warted (*Cucurbita pepo*), no indication of pumpkin. Marrow* on Long Warted; no indication of Marrow. Three common pumpkins on Perfect Gem (*C. pepo*), no indication of common pumpkin. Italian Striped on Sweet Sugar (*C. pepo*), no indication of Italian Striped. Four common pumpkins on Nest-egg gourd (*C. pepo*), no indication of common pumpkin. Two Hubbard (*C. maxima*) on Nest Egg gourd (*C. pepo*), no indication of Hubbard.

This is sufficient to indicate that there is no immediate effect on the fruit. Prof. Bailey says: "It is commonly said that it occurs in pumpkins and squashes also; but it certainly does not. There has never been any immediate influence whatever in any of our crosses, except such as were due to imperfect development caused by an insufficient or impotent pollen. In other words, the effects of the cross are seen only in the offspring of the fruits."

Many interesting experiments have been made to show that in many plants self-fertilization does not occur. *Trifolium pratense* has perhaps received more attention than most plants, and many interesting experiments have been made, which show that self-fertilization does not occur.† But many other plants have been experimented with and very positive evidence has been obtained to show that there are cases much more pronounced than this.

Experiments have been made with cucurbits. Halsted‡ covered ten muskmelons, and in no case did fruit develop. Bailey § has also reported some interesting cases.

Our own experiments are not numerous but they are decisive in every case. Quite a number of muskmelons were covered and left to self-fertilize, with no development.

Can hybrids be produced between *Cucurbita pepo* and *C. maxima?*

Out of fifteen hand pollinations made only two reached maturity. Whether we have here two real hybrids can not be said until the next crop. It may be doubted, however, as we often found beetles in the flowers covered with bags. The chances are against the specimens being hybrids.

Do different varieties of *Cucurbita pepo* cross?

Out of fifteen hand pollinations made the majority set and matured.

In addition to these, others set but did not fully ripen, or grew for some time, and then rotted and dropped off. Others did not develop.

Can perfect fruit be produced between *Cucurbita pepo* and *Citrullus vulgaris*?

In only a single case did fruit develop till half ripe between Mountain Sweet and Sweet Sugar pumpkin, but here again there are grave doubts as to its having been fertilized by the pollen from pumpkin, as beetles were so commonly found in the bags.

Can fruit be produced between *Cucurbita maxima* and *C. pepo*, and between *C. melo* and cucumbers?

In this experiment in many cases reciprocal pollen was used, and there are excellent indications that these distinct species do not "mix." This experiment did not

---

* Sold to us as Mammoth Chili, but according to Vilmorin appears to be a Marrow, a true *C. pepo*.

† See Darwin: Cross and Self-fertilization of Plants. Beal: Grasses of North America.

‡ Bul. Dept. Bot. Iowa Agrl. College, 1886, p. 39.

§ Bul. Cornell Agrl. Expt. Station.

show the results in closely related garden varieties of the same species. The matter of crossing cucurbits is not easy. It should be remembered that of the enormous number of pistillate flowers produced on a single plant but few squashes develop. Early in the season with some varieties like Italian Striped, few of the pistillate flowers, although fertilized, developed. The fruit invariably rotted; some withered on the vine when half grown. This was true also of such forms as Golden Bush, Long Warted, Turban, and common pumpkins. So that our failures are not to be wondered at. These failures were more common early in the season than later. For this there are two causes. When the work began there was considerable rain and great liability to rot, especially pronounced in varieties with a great deal of foliage like Italian Striped.

In crossing we chose the afternoon as being more convenient, but experience soon taught us that early morning was the proper time. Aubert, who has done some crossing with melons, states that he found that the morning gave him best results.

From this work I think we may fairly conclude that under natural conditions the different species of cucurbits will not cross. The several cases in which fruit has been produced may be due to the accidental carrying of pollen by insects, especially by the striped cucumber beetle, which gets in the bag.

The SECRETARY. The section on agriculture will have a meeting just before the convening of the general session to-morrow morning.

The meeting then adjourned.

MORNING SESSION, THURSDAY, NOVEMBER 17, 1892.

The meeting was called to order in the lecture hall of Tulane University at 10 a. m.

MR. ALVORD. Mr. Chairman, I have an announcement to make. It should be noted that all sections will have an opportunity of holding meetings directly after the adjournment of the general session this morning, and it is requested that all sections should be prepared to report their organization for the next year at the general session this evening, and also to present to the general session all matters of business on the part of the sections which require confirmatory action of the Association in general session. The regular program of the convention provides for sessions of all the sections this afternoon, and, so far as I know, there is no disposition to change that feature of the program, but there is from the local committee an invitation to all members to participate in an excursion on the river to Chalmette and Southport, which starts at 1 o'clock.

It is desirable that sections having programs to announce should announce them now. I will repeat the statement made last night that the college section, which meets on the adjournment of the general session, will listen to a discussion on "Waste in College Work," to be opened by President Smart, of Purdue University.

President Nicholson, of the Louisiana State University and Agricultural and Mechanical College, desires to make a statement.

MR. NICHOLSON. I wish to say to the convention that I will have to leave for Baton Rouge this afternoon and will take this opportunity of saying that the most cordial invitation is extended to all the delegates

here to come to Baton Rouge to-morrow. It is understood that a special train will leave here to-morrow morning at 7 o'clock. It is contemplated that you will stop at one or two of the principal sugarhouses on the way, and you will probably reach Baton Rouge about 12 o'clock, or, perhaps, a little later. We will give you dinner there, but inasmuch as you will only be there about four hours we do not propose to make it a social dinner, because we want to show you something else. On the return trip the train will leave at 4 o'clock, in time for you to catch the evening trains here. Should you desire not to come back to New Orleans you can leave just as well from Baton Rouge as here. I observe that there are about one hundred and forty delegates here. We shall expect all of these one hundred and forty delegates to-morrow at Baton Rouge.

Mr. LEE, of Mississippi. I make a motion that a committee be appointed to designate officers for the Association for next year.

The motion was carried.

Mr. LEE, of Mississippi. I desire to present the following resolution:

Resolved, That this Association approves the recommendation of its president as contained in his annual address, and suggests to each institution receiving the benefits of the land-grant act of 1862 that there be placed in its library a bust of the author of that law and of the supplementary act of 1890—the Hon. Justin S. Morrill, of Vermont; that this subject be referred to the executive committee of the Association for appropriate action.

The PRESIDENT. Without a motion this will be referred to the executive committee.

The SECRETARY. Mr. Chairman, I have a telegram from Washington:

WASHINGTON, D. C., *November 16, 1892.*

A. W. HARRIS, for the Convention of Colleges and Stations,
New Orleans, La.:

Regret I can not leave. Reports are being prepared to the President of both the Department and the Exposition, to be presented this week. I wanted very much to look into your faces once more, officially, and to feel the inspiration of your work, but other duties intervene.

EDWIN WILLITS,
Assistant Secretary.

Mr. ARMSBY. I desire to offer a resolution:

Resolved, That the representatives of this Association upon the supervising committee for the Dairy Test at the World's Columbian Exposition be instructed to confer with Chief Buchanan in regard to editing and publishing the detailed records of said tests and to coöperate in making available to the experiment stations and the public the scientific and practical results.

The PRESIDENT. If there is no objection this will be referred to the executive committee.

Mr. ALVORD. I move, individually, that a committee of three be appointed to consider the courtesies extended to delegates to this convention during its session and to report appropriate resolutions thereon to the evening session of this Association.

The motion was carried.

The PRESIDENT. Is there any other miscellaneous business?

Mr. SANBORN. I offer the following:

Resolved, That it is the sense of this convention that the programs for future conventions be confined mainly to administrative and experimental questions that occur in the work of the colleges and stations, to the end that errors in methods of research, teaching, and administration may be eliminated and that the best methods growing out of common experience may be introduced by the several colleges and stations of the country.

This resolution was reported adversely by executive committee and was not adopted.

The PRESIDENT. If there is no other miscellaneous business we will proceed in regular order. We will now have a report by Director Armsby, of Pennsylvania, on the collective station exhibit at the World's Columbian Exposition.

Mr. Armsby submitted the following report:

REPORT OF COMMITTEE ON COÖPERATIVE STATION EXHIBIT AT THE WORLD'S COLUMBIAN EXPOSITION.

Your committee is glad to be able to report substantial progress and to express the belief that, if the contributions which have been promised are forthcoming at the proper time, we shall have an abundance of material for a most full and creditable exhibit of the work of the American experiment stations.

At the outset of our report it seems proper to call attention to the fact that we are reporting upon one aspect of a coöperative work. The initiative in this matter, it will be remembered, was taken by the U. S. Department of Agriculture, and it was the presentation of the subject by Mr. A. W. Harris, director (then assistant director) of the Office of Experiment Stations, at the convention of 1890, that led to the appointment of this committee. The resolution under which we were appointed recognized these facts and directed us to coöperate with the Department. These instructions have been strictly complied with and there has been the fullest and freest coöperation at every step. Whatever success the exhibit may meet with will be very largely due to the generous financial aid of the Department of Agriculture and to an even greater degree to the personal interest and counsel of its officials, especially of Assistant Secretary Willits.

Relations to the college exhibit.—It will be remembered that at the last convention of the Association a committee on a coöperative college exhibit was appointed and that the committees were instructed to coöperate. It was the understanding of both committees that the purpose of the Association in this action was not to set up two separate exhibits side by side, but to make the special work of each committee an integral part of a single combined exhibit of the twofold work of instruction and experimentation carried on by the institutions represented in the Association. There has, therefore, been the fullest coöperation and harmony between the two committees at every stage of the work, and, indeed, in all matters pertaining to the exhibit as a whole they have practically acted as one committee. While, consequently, this report relates specifically to the exhibit of the stations, it will necessarily include some references to points relating to the college exhibit.

Since its last report your committee has held meetings jointly with the college committee as follows: at Chicago, October 27 and 28, 1891; at Washington, September 15 and 16, 1892; at Chicago, November 12, 1892, and during the present convention. The chairmen of the two committees also had a conference with Chief Buchanan, of the agricultural department of the Exposition, and with the U. S. Department of Agriculture on January 27, 1892, at which time a definite assignment of space was made for the exhibit. It does not seem necessary to go into a detailed

report of these various meetings. In place of that we desire to present a brief, general statement of what has been accomplished up to date.

Scope of the exhibit—As was explained in the former report of our committee and in the various circulars which it has issued, the exhibit is to be a "coöperative exhibit," showing the work of the institutions as a whole, rather than the complete work of any one institution. As intimated above, it is to be a unified exhibit, showing upon one side the experimental work of the stations and on the other the teaching work of the colleges. Between these two, and forming a connecting link, there are to be located such exhibits of the equipment and lines of work of the individual institutions as can be made by means of pictures, charts, etc., and also the working laboratories, showing the equipment for investigation and instruction, respectively, and exhibiting some of the simpler and more striking operations in each. It is also regarded as essential that competent demonstrators shall be in attendance to explain the exhibit. This it is hoped to provide for by a loan from the various stations of the services of one or more of their assistants for a limited time. This subject was before the general meeting of the two committees at Washington in September last, and the following resolution was adopted as expressing the judgment of the committees on this point:

Resolved, That, in the opinion of the committee, each college and each station should be requested to provide one attendant, who shall remain at the Exposition one month as demonstrator, his expenses during that time to be defrayed by the college or station sending him.

Location.—A vote of the Association at its last convention referred the question of the location of the experiment station exhibit to this committee in consultation with the Department of Agriculture and with the executive committee of the Association. At a joint meeting of the college and station committees in Chicago in November, 1891, this question was carefully considered and a change of location from the Government building to the Agricultural building was decided upon. The principal reasons for making the change were: First. That the college exhibit could not be made in the Government building, and the change was, therefore, necessary in order to combine the college and station exhibit into a whole. Second. That it was found possible to obtain considerably more space for the exhibit in the Agricultural building than was available in the Government building. Third. That a location in the Agricultural building would bring the exhibit more directly and effectively before the farmers of the country. The position assigned to the exhibits is a very advantageous one in the southwest corner of the Agricultural building, on the main floor, and immediately adjoining the exits leading to the colonnade connecting the Agricultural building with Machinery Hall and also the entrance to the Assembly Hall. The total amount of space assigned is 8,599.5 square feet, or nearly one-fifth of an acre. This is exclusive of the exterior aisles, varying from 10 to 18 feet in width, which surround the whole space. In this connection we desire to express our appreciation of the interest in our exhibit manifested by Mr. W. I. Buchanan, chief of the Department of Agriculture, especially as shown in this very liberal allotment of space, which, it should be added, was made considerably in advance of most other assignments in order to enable the committee to carry on its work to the best advantage.

Securing exhibits.—The main work of the committee, of course, has been the securing of exhibits typical of the work of the stations in their various departments. For this purpose, as explained in a former report, the preparation of each of the several departments of the exhibit was put in charge of a specialist under the general authority of the committee. These gentlemen and others whom they have associated with themselves have contributed freely of their time and ability to the work, often at considerable personal inconvenience, without other recompense than the satisfaction arising from the sense of contributing to the general welfare. Some changes have been necessary during the year, certain gentlemen finding it impossi-

ble to carry the work. Prof. Paquin, in charge of the veterinary portion of the exhibit, has severed his connection with experiment station work. His place was filled by the appointment of Dr. W. L. Williams, of Purdue University, who in turn finds himself unable to continue the work, and Prof. E. A. A. Grange, of Michigan, has been requested to take charge of it. Messrs. Cooke and Thorne have felt obliged to resign the charge of the dairy and fertilizer exhibits, respectively, on account of very great pressure of work, and Messrs. H. H. Wing, of Cornell, and M. A. Scovell, of Kentucky, have been appointed in their places. All those in charge of specific departments of the exhibit have been appointed special agents of the Department of Agriculture, so that the expense of postage has thus been provided for. The committee has received full reports from all but one of these gentlemen. These reports need not be gone into in detail, but in general it may be said that in nearly every case the contributions promised are sufficient to insure a most interesting and typical exhibit of the work of the experiment stations in these several departments.

Work still to be done.—As will appear from what has been said, your committee feels that it has good grounds for confidence in the success of the exhibit. At the same time it is the part of wisdom to face fairly and fully the fact that abundance of time still remains in which to make a most disastrous failure. The buildings of the Exposition will soon be open for the reception of exhibits. With all the work which has been done your committee is as yet able to put its hand upon very few exhibits that are actually prepared and ready for shipment. We have plenty of promises and we have every reason to believe that they will be honored, but it will not do to ignore the fact that very much still remains to be done.

Your committee is fully alive to its own responsibility in this particular. It has received, as already stated, detailed reports from most of the gentlemen in charge of the different departments of the exhibit, showing what exhibits had been offered in their several departments and the amount of space and size and style of cases desired, and it also expects similar reports from the others in the immediate future. At its meeting last week in Chicago, it also, in company with the director of the Office of Experiment Stations, representing the Department of Agriculture, and with numerous delegates to this convention, visited the Agricultural building and conferred with Chief Buchanan. Having all these data in hand, it is the purpose to proceed at once, in coöperation with the Department of Agriculture, with the designing and construction of cases and the arrangement and coördination of the exhibit as a whole. This work will be pushed forward as rapidly as possible, and we hope to have ready in ample season all the cases, etc., needed for the installation of the exhibit. But here our power ends. We can put the cases on the floor of the Agricultural building, we can arrange them and label them and decorate them, but we can not fill them.

We desire to impress upon every delegate present the importance of prompt action in the preparation of exhibits. Those of us who have visited the Exposition grounds and have seen the immense buildings begin to realize the enormous amount of material which will be brought in there during the next six months. Very thorough arrangements as to the shipping and receiving of exhibits are being perfected by the Government board, and we shall share in their benefits, but at best the proper installation of the exhibit under such conditions will require considerable time. It can be accomplished at all only by having all the material ready for shipping early, so that it may be on hand promptly when needed. The success of the exhibit, in our judgment, depends more upon this than upon any other point.

We hope we may count also upon the interest and the support, moral and material, of governing boards and of those in control of the financial affairs of the various institutions. While the committee has, in general, met with a hearty and encouraging response to its requests, it has been surprised and somewhat disheartened by the apparent indifference of some institutions and the direct refusal of others to give any material aid or encouragement to the exhibit. Such instances

have led us to fear that the importance of this undertaking and the advantages sure to flow from it, if successful, as well as the very serious consequences of a failure, are not even yet fully appreciated. We believe that a reasonable contribution to this coöperative exhibit is both the duty and the privilege of every station. The United States is now appropriating nearly $700,000 annually to these stations. We believe it has a moral, even if not a legal, right to call upon them, through the Department of Agriculture, to improve this opportunity of showing to Congress, to the people of the United States, and to the world what use they are making of the most magnificent public provision for agricultural experimentation which the world has yet seen. The various State governments, too, are appropriating annually about $150,000 more. They, too, have a right to expect a good showing from their beneficiaries. If we make a meager, discreditable exhibit, the people who pay the taxes will hardly fail to draw the conclusion that the stations are failing to properly administer their trust.

Nor is it our own people alone whose judgment of us will be largely affected by this exhibit. Foreign visitors will be even more influenced in their estimate of us by our exhibit, since they have scarcely any other means of judging. It is anticipated that the agricultural congresses will draw to the Exposition agricultural experts from abroad, who will be specially interested in experiment station work. Moreover, the fact mentioned in the report of the executive committee that our exhibit is to be immediately adjacent to that made by the French Government of methods of teaching agriculture, as well as to that of the Rothamsted Experiment Station, showing the results of fifty years of work, and that in all probability the German experiment stations will make a similar exhibit in our immediate vicinity, brings us into direct competition with these nations. If we fail, we fail before the eyes of the world.

On the other hand, a good exhibit, such as we can easily make by united effort, one which shall properly set forth the range and variety of our work and its economic importance, will, we believe, do more to strengthen each station, even with the people of its own State, than any similar effort otherwise put forth. The occasion presents a great opportunity and a great public duty. There is a tide in the affairs of stations as well as of men. Shall we take it at the flood?

Respectfully submitted.

H. P. Armsby,
W. A. Henry,
Chas. E. Thorne,
S. M. Tracy,
G. E. Morrow,
Committee.

Mr. Dabney. I am glad indeed to get the information contained in this paper. It contained a great deal that we wanted to hear. The gentleman who prepared the report mentions the fact that some governing boards of institutions have been slow to act in making provision for the exhibit. If we have been, it is wholly from the want of information. This report supplies a good deal of information needed. To illustrate by our own case, I will say that we have never fairly understood exactly what part our station would take in the collective exhibit. They were laboring under the impression that the exhibit would be taken care of by the Department of Agriculture as a portion of the exhibit of the U. S. Department of Agriculture. While we have been preparing our exhibit so far we have made no provision and I do not think the trustees contemplate making a provision for the expense of taking care of the exhibit after it reaches Chicago. Our board meets

in December and it is desirable that we should know what expenses we are expected to provide for, and as it will be the last meeting before spring I would like to have a little more information along that line. What is expected of us, financially?

Mr. ROBERTS. Will you allow me to remark that there is another report which will explain what Dr. Dabney wishes to know?

The PRESIDENT. I will now name the committees appointed. The committee to propose proper resolutions for courtesies extended the convention, Messrs. Morrow, Scott, and Wiley. The committee for nominating officers for the ensuing year, Messrs. Lee of Mississippi, Goodell, Thorne, Neilson, Hadley, Loughridge, and Wing.

We will now have the report of the committee on the collective college exhibit.

Mr. Alvord submitted the following report.

REPORT OF THE COMMITTEE ON THE COLLECTIVE COLLEGE EXHIBIT AT THE WORLD'S COLUMBIAN EXPOSITION.

After the resignation of Presidents Atherton and Smart from this special committee as originally appointed, its duties were assumed by the executive committee, and the work since done is now reported upon for that committee.

Early in September an office was opened in Washington city and active operations begun to interest the trustees and executive officers of the various colleges and other institutions receiving the benefits of the act of Congress of July, 1862, and August, 1890, in the proposed collective exhibit by these institutions, in the Agricultural Building of the Exposition. While the U. S. Department of Agriculture is unable to directly recognize this effort on the part of the colleges, it has shown much interest in the subject and has in various ways materially promoted the same.

This committee has coöperated with the one in charge of the exhibit of the experiment stations and shares with the latter in the general space assigned by the chief of the Department of Agriculture of the Exposition. The laboratories for illustrating work in chemistry, botany, and zoölogy and the veterinary alcoves will occupy space to some extent common to the college and station exhibits and represent instruction and the facilities for instruction in those departments, as well as investigation therein. Adjoining the zoölogical laboratory and veterinary alcove, a rectangular space 30 by 34 feet has been assigned for the department of college instruction in agriculture and horticulture. Just across the central aisle, four apartments or divisions are laid out, to be occupied respectively by (1) chemistry, (2) civil engineering and drawing, (3) domestic and fine arts (mainly women's work), and (4) mechanic arts and engineering, including electricity. The first three named have each a floor space about 17 feet square, and the last one a space 22 by 40 feet.

It is proposed to ask the various colleges to loan for exhibit in these different departments models, apparatus, and other material showing the facilities they possess for giving instruction in the several lines named, and also material in objects, illustrations, or data, showing the results of such instruction. It is believed that the preparation of the material can be accomplished without burdensome labor on the part of the colleges and that it can be arranged to transport the same to Chicago, install and care for the exhibits, and return the property without direct cost to the contributing institutions. It becomes, virtually, a loan exhibition, the several contributors being at some trouble, but very little expense, in suitably preparing the articles for exhibition.

Every article or part of the exhibit will have proper labels attached, indicating what institution is the owner and contributor. It is not expected that any one col-

lege will largely contribute to any one department, but hoped that the colleges will generally be found ready to be represented in several different sections or departments.

The committee in the course of its work thus far has found a general desire on the part of the presidents and professors of colleges to have their institutions participate in this exhibit, but in many cases much misconception of the plan in detail and of the labor and expense involved. A greater obstacle to progress is the feeling on the part of a number of boards of trustees that they cannot afford the necessary expense and that, if they could, such use of their funds is inexpedient, if not illegal.

Your committee recommends that this subject be thoroughly discussed at the present convention, with a view to obtaining a consensus of opinion as to what the several land-grant colleges can do and what they ought to do in regard to this exhibit, including the views of college trustees, in order that the same may be formulated for the information and guidance of all concerned.

Attention is also called to the fact that this college exhibit matter is now in the hands of the executive committee which ceases to exist with the adjournment of this convention. Suitable provision should therefore be made for continuing the work.

Respectfully submitted.

HENRY E. ALVORD,
Chairman.

The PRESIDENT. We will next have the report of the committee on the World's Agricultural Congress.

Mr. Morrow presented the following report:

REPORT OF THE COMMITTEE ON THE WORLD'S AGRICULTURAL CONGRESS.

The committee of conference with the authorities of the World's Columbian Exposition, as represented by the World's Congress Auxiliary, concerning the Agricultural Congress to be held during the Exposition, take pleasure in reporting that the plans for that congress are so far perfected as to assure its marked success.

The Congress will be held during the last half of the month of October, 1893, in the new and magnificent Art Palace in Chicago, in which is provided a large number of audience rooms with seating capacity of from 300 to 3,000. If desirable, sessions of the Congress may be held in the assembly hall of the Agricultural Building on the Exposition grounds, near the collective exhibit of the colleges and stations.

As the Exposition Authorities, through the Congress Auxiliary, assume full responsibility for the congresses in the matter of providing meeting places, printing, and distributing announcements and programs, and hope to provide for the publication of the proceedings, the arrangements for each congress rest with this auxiliary, a control committee of which, mainly made up of persons living near Chicago, is appointed for each congress. There are also special committees for each division of the different congresses.

Still further, there are advisory councils composed of persons especially eminent in the department covered by the congress and honorary members of each congress.

This Association has been recognized in these committees and will be very prominently represented in the advisory council and honorary membership.

The Congress Auxiliary also invites the appointment by this Association of a committee of coöperation with the committee of the Auxiliary.

The plans for the Agricultural Congress provide for sessions of the congress as a whole, for addresses from the official representatives of agriculture in different nations, and other addresses of general interest; also for meetings of the following divisions:

(1) General farm culture; (2) animal industry; (3) horticulture (in August); (4) organization and legislation; (5) education and experiment.

So far as may be advisable the different divisions will also subdivide for sectional meetings.

Agricultural education has been assigned a place in the educational congress to be held in July, and this Association is represented on the committees for that congress.

The committee desires to express its hearty appreciation of the cordial interest shown in the Agricultural Congress by the Congress Auxiliary, through its president, Hon. C. C. Bonney, of Chicago.

The chairman also desires to express his appreciation of the aid given him by Assistant Secretary of Agriculture Willits, and his regret that it was found impracticable to frequently confer with the other member of the committee, the honorable president of this Association.

The committee has had a constantly increasing appreciation of the importance of the great series of world's congresses, of which that devoted to agriculture forms a part, and, in some sense, a climax; of the thoroughness of the plans and organization of the Congress Auxiliary and the abundant provision made for places of meeting, publication, etc., and of the widespread interest taken in many of the congresses. It records its conviction that the Agricultural Congress will be the most largely attended and most important meeting of the kind ever held, and that the extraordinarily favorable connection of this Association with the Congress makes it a duty, as well as a privilege, for the Association to exert itself to the fullest extent in utilizing this unprecedented opportunity for widening the influence of the institutions of which it is composed, not only by participation in the division of the Congress in which there is the most direct interest, but equally in each of the others.

The committee recommends that this Association, officially and through its membership, give the heartiest coöperation to the World's Congress Auxiliary of the World's Columbian Exposition, in preparing for the Agricultural Congress to be held in Chicago the last half of October, 1893.

That a committee of coöperation, consisting of five members, be appointed to aid the committee of the auxiliary, having the Agricultural Congress in charge, and also to give such assistance as may be necessary in having a suitable recognition of agricultural education in the several educational congresses to be held in July, 1893.

As it is believed it will be most advisable that the annual meeting of this Association for 1893 be held at Chicago in connection with this Congress, in which case it is important that the officers of the Association should be in intimate relations with the Congress, it is recommended that the appointment of the committee be left to the executive committee.

It is further recommended that the members of the Association nominate to the agricultural committee of the Congress Auxiliary the names of suitable persons to be placed on the advisory council, and also those best entitled to recognition as honorary and corresponding members of the Congress.

G. E. Morrow,
Chairman for the Committee.

A full discussion followed, participated in by a number of delegates, regarding the subjects presented by the three reports preceding, and the work of the colleges and stations in connection with the proposed exhibits.

Mr. Morrow. As this question involves finance, I will ask if it will not be a matter to refer to the executive committee.

The President. Each of these reports will be referred to the executive committee, if there is no objection. They are so referred.

Mr. MORROW. In accordance with the request of the World's Congress Auxiliary that this Association appoint a committee to coöperate with the committee on the Agricultural Congress, and owing to the important relation in which this committee stands, it should be appointed by the executive committee. I will therefore move that the recommendations of this committee be approved.

The motion was carried.

Mr. MERRY (agent of the Illinois Central Railroad). I desire to make the announcement that a special train will leave at 7 o'clock. The railroad schedule is not quite so flexible as the time for convening of the Association. It will therefore be absolutely necessary that every member of the convention who desires to make the trip shall be at the Illinois Central depot at 7 o'clock.

The Association then adjourned at 12 o'clock.

EVENING SESSION, THURSDAY, NOVEMBER 17, 1892.

The meeting was called to order by Vice-President Dabney at 8 o'clock.

The PRESIDING OFFICER. The program for this evening calls for the consideration of resolutions and general business.

Mr. Alvord here presented the program of the evening slightly changed.

The PRESIDING OFFICER. The executive committee have arranged the program as follows: First, the report of the committee appointed to confer with the Weather Bureau, Mr. Harris, chairman.

Mr. HARRIS. I am not chairman of that committee, but am requested to present the report. It is as follows:

REPORT OF COMMITTEE ON COÖPERATION WITH THE UNITED STATES WEATHER BUREAU.

MR. PRESIDENT AND GENTLEMEN OF THE ASSOCIATION: Immediately after the close of the Washington convention your committee called upon the Assistant Secretary of Agriculture and the Chief of the Weather Bureau. Secretary Willits expressed his hearty sympathy with the Association and paved the way for numerous interviews with Prof. Harrington. He received us most cordially and declared his desire to aid us.

In order to gather together the information already in existence in regard to the relations of agriculture and meteorology, he asked your committee to suggest to him subjects which should be studied and the names of persons qualified for this work. These suggestions were promptly adopted, and as a result the Bureau has published two bulletins, with which the members of this Association are already familiar. They are: By Prof. Hilgard, on Relations of Soils to Climate; by Prof. Whitney, on Some Physical Properties of Soils in their Relation to Moisture and Crop Distribution.

Prof. Harrington has also furnished to the Office of Experiment Stations a bulletin on Meteorological Work for Agricultural Experiment Stations.

Much has also been attempted for agriculture in the regular work of the Bureau.

Cotton region service.—The Bureau has continued to render important information to cotton-growers. After consultation with the observers in charge of the several

centers and upon the urgent requests of the commercial exchanges, the time for taking and reporting the observations was extended. These are now made from April 16 to November 30 of each year. Many requests for the establishment of new stations have been received; but it has been only practicable to open two. In order to establish nine stations of a somewhat similar character in the sugar and rice growing districts, and to keep within the appropriation, it was necessary to discontinue nine of the less important cotton region stations.

Flood predictions.—There are now in active operation 166 special river stations and 59 special rainfall stations. These are arranged in groups or sections under the supervision of central stations. The river observers record the rainfall also. River bulletins are issued at 22 places. Stage predictions of some of the principal rivers are made daily at Washington and local predictions are made at many points.

State weather service.—State weather service work has been carried on to a much greater extent than heretofore; and the results accomplished prove the usefulness and importance of this branch of the Bureau. The entire territory of the United States with the exception of Alaska is now covered by local weather services, the last organized being that for Idaho. The regular monthly reports now contain important tables, and it is possible now to obtain the special features of the climate of every section of the country. Thus farmers, and all others have a means of securing detailed information.

Besides the National Bulletin, all the States and Territories, except Nevada and Idaho, issue local bulletins during the season of planting, cultivation, and harvesting of crops which form a most important feature of State weather service work. Such has been the demand for the National Bulletin that the edition has been more than doubled and yet the demand increases. The text of the bulletin is telegraphed by the press associations and is reproduced either in whole or in part in many papers.

The distribution of forecasts, frosts, and cold-wave warnings has greatly increased during the past year, but has been hampered by inadequate appropriations for telegraphic purposes. The increase in the number of stations supplied by telegraph at Government expense with the daily forecasts, as compared with the number supplied on June 30, 1891, is over 200 per cent, and on the 1st of July, 1892, our lists show a total number of 1,888 receiving a daily telegram at the expense of the Weather Bureau.

A large number of applications could not be favorably considered, as the allotment of the telegraph appropriation would not admit of any increase over the number already supplied. One hundred and thirty-six stations have been established under the auspices of the National Grange of the Patrons of Husbandry, many of which were supplied with flags by the Weather Bureau, while others disseminated the forecasts and warnings by means of steam whistles.

The railroad telegraph and train service, as gratuitous means of distribution, are largely utilized, and nearly 3,000 places receive the forecasts daily in this manner, and over 1,000 points are supplied by mail or a free telegraph or telephone service.

The PRESIDING OFFICER. What will you do with the report, gentlemen?

The report was accepted and placed in the hands of the executive committee.

Mr. ALVORD. If there are no other matters of special business to be brought up the executive committee is ready to report back the resolutions referred to it for the action of the convention.

Dr. Armsby's resolution is somewhat modified and recommended for adoption in the following form:

Resolved, That the representatives of this Association upon the supervising committee for the dairy tests at the World's Columbian Exposition be instructed to con-

fer with Chief Buchanan in regard to editing and publishing the detailed records of said tests, and to coöperate in making available to the experiment stations and the public the scientific and practical results.

The resolution was adopted.

Mr. ALVORD. The following resolution is offered by the executive committee as covering a subject that has not received the attention of the convention up to this time:

Resolved, That the communication from Chief Buchanan of the Department of Agriculture of the World's Columbian Exposition, in relation to a course of popular lectures in connection with the agricultural exhibit be referred to the executive committee with power to coöperate in this project at the discretion of said committee.

The resolution was adopted.

The resolution offered by Mr. Lee is reported back somewhat modified with recommendation for its adoption as follows:

Resolved, That this Association approves the recommendation of its president as contained in the annual address and suggests to each institution receiving the benefits of the land grant act of 1862, that there be placed in its library a bust of the author of that law and of the supplementary act of 1890, the Hon. Justin S. Morrill, of Vermont.

Resolved, That this subject be referred to the executive committee of the Association for appropriate action.

The resolutions were adopted.

The executive committee offered a resolution as to the annual dues of institutions.

Mr. ROBERTS. When the constitution was adopted I ran against the word institution, and it was not defined there so that I could understand it. Many stations are added to a college and are not institutions in any sense of the word—they are departments of institutions; so it seems to me that a little explanation is necessary in this resolution—at least it took me a considerable time to get through my head that wherever the word "institution" occurred in the constitution, and in this resolution it means a college or an experiment station, and that the dues will be $10 for each college and $10 for each experiment station.

The SECRETARY. I think the point well taken. I am frequently written and asked whether that means for the whole institution.

Mr. HAYS. I move that the resolution read, instead of "each institution," "each college and each experiment station."

The executive committee accepted the amendment, and the resolution was adopted, as follows:

Resolved, That for the ensuing year the annual dues for each college and each experiment station entitled to membership in this Association shall be $10; and

Resolved further, That in view of possible extraordinary expenses, the executive committee be authorized to call, if necessary, for additional contributions from each college or experiment station, in which case the needs and purposes shall be fully stated.

President Turner, of West Virginia, offered the following resolution, which was handed in directly to the executive committee. The com-

mittee submitted this with the recommendation that it be referred to the new executive committee:

Resolved, That hereafter the annual sessions of the Association shall continue at least four days; and there shall be but one general session each day and but one session of each section each day.

The reference recommended by the committee was ordered.

The following resolution was offered by Mr. Sanborn:

Resolved, That it is the sense of this convention, that the program for future meetings be confined mainly to administrative and experimental questions that occur in the work of colleges and stations to the end that errors in methods of research, teaching, and administration may be eliminated and that the best methods growing out of common experience may be introduced by the several colleges and stations of the country.

The committee sympathized with the spirit of this resolution, but believed the desired object could be attained by a strict construction of the constitution without further legislation and therefore recommended that this resolution be referred to the new executive committee.

The recommendation of the executive committee was adopted.

The executive committee recommended that when the present general session adjourn, it should be to meet the next evening at Parlor P. of the St. Charles Hotel, with the understanding that nothing but the usual closing business of the convention be then transacted—acknowledgments of courtesies and so on—and that the special committee appointed on that subject be then called upon to report.

On motion the recommendation of the executive committee was adopted.

ELECTION OF OFFICERS.

The PRESIDING OFFICER. The next thing, gentlemen, according to the program is the election of officers. We will now have the report of the nominating committee.

Mr. LEE, of Mississippi. The committee submit the following names for officers for the next year:

President, W. A. Henry, Wisconsin.

Vice-presidents, W. C. Stubbs, Louisiana; E. W. Hilgard, California; John A. Myers, West Virginia; A. Q. Holladay, North Carolina; J. F. Hickman, Ohio.

Secretary and treasurer, M. A. Scovell, Kentucky.

Bibliographer, S. W. Johnson, Connecticut.

Executive committee, H. E. Alvord, District of Columbia; James Neilson, New Jersey; H. H. Goodell, Massachusetts; C. W. Dabney, jr., Tennessee; the president, junior ex-president, and the secretary and treasurer.

The PRESIDING OFFICER. Gentlemen, you have heard the report of committee. What will you do with it?

Mr. ROBERTS. I move that the report be accepted.

Carried.

Mr. HAYS. I move that the secretary be instructed to cast the ballot for the Association.

Carried, and the secretary was instructed to cast the ballot for the Association.

This being done, the nominees reported by the committee were declared to be duly elected.

The PRESIDING OFFICER. Next, reports from sections. I will call them in no particular order. The Section on College Work.

Mr. Turner reported the following nominations for officers of that section: Chairman, President C. W. Dabney, of Tennessee; vice-chairman, President George T. Fairchild, of Kansas; secretary, President M. C. Fernald, of Maine.

Mr. ALVORD. I move that the nominations for chairman and secretary be confirmed. We have nothing to do with the vice-chairman.

Carried.

Next, the Section on Agriculture and Chemistry.

Mr. HUNT. Mr. Quick was expected to make the report. I will say that the nominations were as follows: Chairman, W. A. Henry, of Wisconsin; vice-chairman, W. C. Stubbs, of Louisiana; Secretary, W. C. Latta, of Indiana.

Nominations confirmed.

Next, Section on Horticulture and Botany.

The secretary read the nominations submitted as follows: Chairman, F. Lamson-Scribner, of Tennessee; Secretary, E. S. Goff, of Wisconsin. Nominations confirmed.

Next, Section on Entomology.

The secretary said that he had been requested by Mr. Osborn to state—

That, as only two entomologists were present at the time for organization of that section and as neither of the officers was here, it was deemed best not to organize the section, and consequently no nominations were ready. And to ask that the Association elect officers for the coming year, as it is probable that there will be a better attendance and it will be desirable to have a report of progress in that line.

Mr. SANBORN. I move that Mr. H. Osborn be made chairman of the section.

The PRESIDING OFFICER. Is this regular; can it be done? I think under the constitution a section must elect its own officers.

Mr. DEPASS. I think we are equal to the occasion.

Mr. TRACY. I think the constitution says the old officers shall hold over.

The PRESIDING OFFICER. The officers will hold over.

Mr. LEE, of Mississippi. The Section on Mechanic Arts reports the following nominations: Chairman, C. W. Hall, of Minnesota; secretary, F. Paul Anderson, of Kentucky.

Nominations confirmed.

The PRESIDING OFFICER. I believe there is a committee to report at this time on the Test of dairy cows at the World's Columbian Exposition.

Mr. NEALE, of Delaware. The following resolution was handed to your committee for consideration:

Whereas this Association has received a request from the authorities of the World's Columbian Exposition to nominate four persons to be appointed members of the committee to supervise the tests of dairy cows during the exposition at Chicago; and

Whereas this is a subject of such importance as to require the most careful consideration, with a view to appropriate action: Therefore,

Resolved, That a committee of five be appointed by the Chair to consider this subject and to report to this convention the names of four persons suitable for members of the said testing committee, and to also report what further action is advisable in the premises.

Referred by the president to Dr. A. T. Neale, of Delaware; Dr. G. W. Atherton, of Pennsylvania; Dr. J. A. Myers, of West Virginia; Prof. W. A. Henry, of Wisconsin; Prof. F. A. Gulley, of Arizona.

The committee to which was referred the above resolutions respectfully reports the names of four gentlemen, viz: M. A. Scovell, of Kentucky, chairman; I. P. Roberts, of New York; S. M. Babcock, of Wisconsin; H. P. Armsby, of Pennsylvania; and respectfully suggests that the executive committee of this Association be authorized to provide, on consultation with the above-named gentlemen of the testing committee, for the payment of the necessary expenses incurred by said gentlemen in supervising said tests, funds to be secured in such manner as may be found to be most expedient.

A. T. NEALE,
GEO. W. ATHERTON,
W. A. HENRY,
JOHN A. MYERS.

The report of the committee was adopted.

Mr. SMART. The committee appointed to consider the question of compiling intercollegiate statistics has held a meeting to consider the subject as fully as possible under the circumstances. The committee finds itself unable to report a plan for permanent adoption, and it therefore has prepared a resolution which will cover the ground for the present and suggests that a committee be appointed to consider the subject further. President Atherton will read the report.

Mr. ATHERTON. The committee have had the subject under consideration and make the following recommendation:

(1) That a committee of three be appointed, whose duty it shall be, by conference with members of the Association and by such other means as they may find advisable, to prepare a form of blank which will present in the most simple and complete manner such statistics of the resources, income, expenditures, and activities of the colleges forming this Association as are likely to be most generally desired, and to gather, collate, and distribute such statistics as early as practicable.

(2) That the said committee shall report to this Association at its next convention a plan for the permanent continuance of such work.

J. H. SMART.
GEO. W. ATHERTON.
HENRY H. GOODELL.

If it is the proper stage of the proceedings, I move the continuance of the same committee on this subject.

Mr. SMART. I suggest that Mr. Atherton be made chairman of this committee as he has agreed to do the work, and it is proper that the circulars should go out in his name.

Adopted.

Mr. ATHERTON. May I make a single request of the college and station men present. That before leaving the city or immediately after, they mail me at my home a statement of the things they desire to be included in these statistics, and when we get up a blank it will contain all suggestions from all quarters.

The PRESIDING OFFICER. Anything further.

Mr. FREAR. I move that the executive committee be instructed to coöperate with the director of the Office of Experiment Stations in the preparation and editing of the proceedings of this convention for publication.

Carried.

Mr. ATHERTON. I have one more matter that I desire to bring before the Association, which I think is of importance. In the report of the Knoxville meeting on p. 96 it will be found that the Association took action previous to the incoming (present) administration at Washington for the purpose of impressing upon the President, then elect, and upon the Secretary of Agriculture to be appointed, the importance of keeping the scientific work of the Department as closely as possible under his own control and direction, so that the Secretary in his administration of the Department should so far as possible be able to coöperate with the Association. The President-elect and the new Secretary of Agriculture very cordially responded to that suggestion and the whole policy of the new Department was based especially upon the suggestion of the Association in that respect. I now suggest to the Association considering the present turn of things, a new administration coming in, whether it is not expedient and feasible that the same step should be taken? With that view I have taken up the two preambles of the resolution then adopted, which I will ask leave to read, accompanied with another preamble and a short resolution:

Whereas the Department of Agriculture has become one of the important scientific departments of the executive branch of the Government of the United States, and in reality a great experiment station in itself, its various divisions being managed in most cases by men of recognized ability and scientific attainments; and

Whereas recent years have rapidly developed the character of this Department, which, if the system of State experiment stations be included, now exceeds in magnitude any other scientific work of the Federal Government; and

Whereas this encouraging development and satisfactory condition of the scientific work is largely due to the broad-minded and enlightened policy which has been pursued for several years past of administering these branches of the Department upon a thoroughly nonpartisan basis, securing permanency in position of their officers and assistants; therefore

Resolved, That the executive committee be, and hereby is, instructed to take such steps as it may deem expedient for calling this entire subject to the attention of the President-elect, and respectfully urging upon him the continuance of the same policy; and

Resolved, That the executive committee be instructed to coöperate with the said Department, in every way possible, in advancing the character and stability of its scientific work.

The preamble and resolutions were adopted after some discussion.

The SECRETARY. I call attention to the fact that the auditing committee has not reported as yet.

Mr. HUNT. Mr. President, your committee to which was referred the report of the treasurer has carefully examined his accounts and find them correct. Vouchers are on file for the amounts paid out, all of which have been properly approved and receipted.

The report was accepted.

Mr. FAIRCHILD. May I ask for information at this point on an entirely different matter? When the reports of presidents of colleges was called for two years ago, the first report of presidents of colleges under the act of 1890, it was announced that the United States Government would consolidate, edit, and publish those reports. I would like to ask the executive committee if anything has been done or why it has not been done? The suggestion was made at the time the report was called for, that it be sent to the Commissioner of Education, the requirements being that reports of the president be sent to the Secretary of Agriculture and the Secretary of the Interior.

Mr. ALVORD. The chief clerk of the Bureau of Education is here and would probably be a better person to answer that question, and he may allude to it presently. I think I may say a word, however. I know that the Department of the Interior has the manuscript now ready for the press.

Mr. FAIRCHILD. May I ask still further on the same subject as to the law requiring these reports be distributed to colleges, a copy is to be sent to each college, I believe, but as yet we have never received such reports. What ought to be done by us in the premises?

Mr. HADLEY. In New Mexico we have the same difficulty that President Fairchild speaks of. We have just received from the printer both of our reports and they are now ready for distribution.

The PRESIDING OFFICER. The time has come when we should take up the discussion of the evening. Under the new Morrill act the colleges have been brought closer to the Bureau of Education than ever before. In view of this the Association has asked the Bureau to send a representative to discuss this matter. Further, we have made this Bureau a regular member of this Association. We have with us Mr. J. W. Holcombe, chief clerk, and I have the pleasure of introducing him for the discussion of the relations of the colleges to the Department of the Interior.

Mr. Holcombe then read the following paper:

The Relation of the Agricultural and Mechanical Colleges to the Department of the Interior.

With so rich a program before the convention it is my duty to be brief and, in connection with the present topic, merely to suggest some of the points for discussion under "the relations of the colleges and the Department of the Interior," presenting a view of those relations from the side of the Department, and giving an opportunity for expressions of opinion to the men who administer the institutions themselves which receive the benefits of the several acts of Congress in aid of colleges of agriculture and the mechanic arts.

The first of these acts, that of 1862, which made the grants of land to the several States, can not be said to have established any relations with the Department of the Interior, as nothing more was required of that Department than the clerical duty of issuing patents and scrip for the location of the land. Even the requirement that an annual report be filed with the Secretary of the Interior has not been insisted upon by the Department and was generally lost sight of by the colleges. The act of 1887 for the encouragement of experiment stations makes the Department of Agriculture an efficient auxiliary and nuifying influence in the work of these useful institutions, but gives the Interior Department no connection with them whatever. The act of 1890 appropriates certain sums directly out of the Federal Treasury, limits the application thereof strictly to certain specified subjects, and goes far beyond the previous acts in the definiteness and its requirements respecting the making of reports, their contents, and the time of filing them. By implication at least, if not directly, it requires a strict accounting to the Federal Government for the use of the funds received. Such implication is found in reading together the mandatory limitations upon the uses to which the fund shall be applied, the mandate that the Secretary of the Interior shall ascertain each year and certify to the Secretary of the Treasury respecting each State and Territory whether it is entitled to receive a share of the fund for that year, and the further mandate charging the Secretary of the Interior with the proper administration of the law. What facts can the Secretary ascertain upon which to decide whether a State is entitled to a payment? Surely no other than whether the funds already received have been applied only to the subjects named in the act of Congress. And how can he make certification to the Secretary of the Treasury, and otherwise properly administer the law, unless he can demand from each State full and complete reports, as detailed, as specific, as inquisitorial as may be necessary to satisfy his mind and conscience; that is, to satisfy the Federal executive power? A great and radical step beyond previous legislation must be recognized here. The land grant of 1862 amounted to an absolute gift. If the institutions established did not teach agriculture or military tactics (and many of them did not do so for years,) the President and his Cabinet and the entire judiciary of the United States might whistle to the winds for redress. But this last act establishes, to put it plainly, Federal control and supervision over the use of the fund created. If any dangers, therefore, lurk in the possibility of Federal interference and Federal dictation, the beneficiaries of this last Congressional grant are liable thereto.

Do we not remember, my hearers, a Will-o'-the-Wisp which led many a vain dance for a dozen years, the steps of which are marked by preambles and resolutions of national and State educational associations, county institutes and other teachers' meetings, religious conventions, synods and assemblies, and gatherings together of every character and description? Do we not all remember it, a delusive phantom now at last happily laid to rest forever: Federal aid to education in the States, familiarly known as the Blair bill. The Blair bill is dead, but this act of 1890 contains some of its features and other features of control which must in time have been added to any measure of Federal aid. What Congress would not do in reference to the general educational systems of the States it has done in reference to

a limited field of the higher education. The cordial acceptance of such a measure by the legislatures of all the States surely indicates that there is no real danger from Federal interference and that jealousy of the Federal power on that score has disappeared. At any rate we need not expect ever to see United States deputy marshals stationed in your class-rooms of economic science to note whether you teach protection or free trade.

But that there is a possibility of Federal dictation in this act is proved by the fact that our distinguished Commissioner of Education, a man who is most emphatic in his belief in State and local autonomy, was yet of the opinion that the words, "the legislature shall propose and report to the Secretary of the Interior a just and equitable division of the fund," gave the Secretary the power and made it his duty to sit in judgment respecting such proposed division. Thus the Secretary could oppose his opinion of justice and equity against that of a State legislature, and in one case the funds of a State were unfortunately withheld till a special act of Congress directed their payment.

But in this connection, let me say I deem it very fortunate that the Secretary of the Interior committed the administration of this act to the Commissioner of Education, rather than to a force of routine clerks in some division of the Secretary's large office. Thus was secured an inauguration of the act from, I may say, a sympathetic point of view with a comprehension of the conditions and needs of the colleges and of the new institutions which were called into being by the act of Congress. The Commissioner and his assistants in the Bureau hailed it as a step which would bring the Bureau of Education into vital relations with these valuable and growing institutions which have been justly called, and doubtless are, the true American universities of the future. It is hoped that the relations thus established may prove more and more helpful to the colleges as the years go by. In this hope the Secretary of the Interior, on the advice of the Commissioner of Education, has sent me to represent them both at this convention, to express their cordial interest in your work, their profound faith in the future of the American colleges of agriculture and the mechanic arts. The action of your association in providing in its constitution that a representative of the Department of the Interior shall be a delegate to your conventions with full rights and privileges of membership will be recognized by them with pleasure as a response in like spirit to their friendly advances.

There are two definite points to which I beg leave to invite your attention. One is the time at which treasurers' reports are to be filed. The law says September 1. Strange to say a few institutions did not have their reports in on time. Some wrote asking if a delay would make any difference, some offered one apology, some another. But, the language of the law being explicit on this point, the Commissioner will have to submit the question to the Assistant Attorney-General before venturing to recommend that any State where such failure has occurred be certified as entitled to the next installment of the fund.

The other matter is the form of the schedules for the treasurers' reports. This form, you will remember, was devised by a committee of this Association, in August, 1891, and was agreed to by the Commissioner of Education. But its sufficiency has been questioned by a number of treasurers themselves, and an experience of two years in handling the returns and conducting a correspondence about them has led me to doubt whether the present form of accounting for the expenditure of the grant of 1890 would stand a crucial test, which might be applied to it some time in the future. I will not go into particulars, as these are well understood by you, but will here leave the subject to be dealt with by the wisdom of the Association.

Mr. SCOTT. I suppose the paper is open for discussion. I have an engagement this evening, but am very anxious to say a word or two on the point last presented by the reader of the paper. In fact I may say

that was one of the main purposes of my coming here at this time. Last year at the convention this matter of a form of schedule for the reports of presidents of colleges to the Secretaries of the Interior and Agriculture seemed to me to be a matter of gravest importance and therefore in the section of college work I urged very strongly that the matter be taken up and that it be given into the hands of a committee then appointed for another purpose. This committee brought this matter, as has been stated by the reader of the paper, to the attention of the Secretary of the Interior, but it seems to me that the result is very unsatisfactory. The representative of the Interior Department has so expressed himself in his paper and I suppose he gives the official sentiment from that source.

I came here for the purpose, let me frankly say, Mr. President, of moving that a special committee be appointed to confer with the proper authorities at Washington for the revision of our form of schedule. No doubt we have begun our books in accordance with this schedule, but already the report comes from the Department that it is unsatisfactory to them and it certainly is to us. I therefore move, Mr. President, that a special committee of three be appointed to consider with the authorities at Washington the advisability of revising the present form of schedule for returns from treasurers of colleges.

The PRESIDING OFFICER. Gentlemen, you have heard the motion. Are you ready for the question?

Mr. ALVORD. I merely rise to ask whether this closes the general discussion. It only covers one point.

Mr. FAIRCHILD. I should like to have Mr. Scott go a little more into particulars and to designate what his idea is with reference to that schedule since the probability is that he will be chairman of that committee.

The PRESIDING OFFICER. We are all interested in this question.

Mr. SCOTT. Of course we wish to conform to the views of the Department first of all. The representative of that Department has not gone into details, and therefore I could not forestall any suggestions that should come from the Department. The motion, if the gentleman will recollect, is that the committee consider the advisability of revising; the Department will pass upon it. There are many particulars that might be stated here. It is most difficult in our bookkeeping to separate the articles. There has never been an official statement as to what is "stock," "materials," "apparatus;" so that it seems to me that this ought to be considered by this committee, that the proper classification should be made to conform exactly to the spirit and letter of the law, and a better classification covering the same ground covered here. I have no special schedule prepared.

Mr. PORTER. President Scott will remember that this question was fully discussed before the commissioner at the time, and all these questions were put to him specifically as to what they meant and a

strict interpretation as to their acceptation. Maj. Alvord was there and probably remembers the conversation. Unfortunately these answers were not put in an official form.

Mr. FAIRCHILD. I wish to express hearty sympathy with the idea of making a more exact report coming from the treasurers, that it be as accurate as possible in the statements as to what we have done with the money, and I wish to second heartily anything to enable institutions to meet the requirements of the law.

Mr. DEPASS. If I understand properly the motion of President Scott it is this: It is on the premise that the Department of the Interior has the right to say what kind of a report should be made, and that this is simply a committee appointed by this body to advise with the Department. The Department at last will decide on the schedule. This is a very reasonable request, and I hope the question will be put and we will let Mr. Scott keep his evening engagement.

Mr. ATHERTON. I would like to ask what especial difficulty Dr. Scott finds. There has been none with us, but I can readily understand where it might arise. I would like to ask Dr. Scott as to how the committee is to get at any judgment in consultation with the officers at Washington which will be any more likely to represent the interests of those present; that is to say, how will this committee when agreeing on something know that they are meeting the views of the Association? I do not see how we are to get any benefit from that plan. It may be just as unsatisfactory. I would like to suggest another plan. Why not submit the question to the executive committee? It seems to me that we should first have a consultation among ourselves and see where the difficulties lie and submit them to the Department. With all respect to Dr. Scott, and a desire to further this idea, I do not see where we will gain anything by this method.

Mr. SCOTT. The object is first to meet the views of the Department, as here expressed, that the schedule on which returns are now made is unsatisfactory. Let us have a committee to consult with the Department and inquire as to its views, and then have the committee obtain the opinion of the treasurers of the different institutions on the proposed form.

I apprehend the very difficulty before was that it was done in a hurry. Mr. Porter states that it was done after full consideration. We did not even think of it ourselves until the motion had been passed in the Section on College Work and the committee instructed to do certain work. It was upon a reconsideration that this matter was brought up at all. That being the case, I assume, further, inasmuch as the result has not proved satisfactory to the Department, that it was done without due deliberation. We have now had the experience of two years. The Department thinks it is not a proper schedule. I think gentlemen of the Association will agree with me that it does not fully answer our purpose. I therefore move that a special committee be

appointed, for, as the reader of the paper has pointed out, in these relations which we sustain to the Federal Government, it is all important that the matter of finances be properly adjusted in these relations. I brought no schedule here, nor do I think that this Association should do this in a hurry. It seems to me that it ought to be done by a committee specially appointed for this purpose to consult with the Interior Department and lay their judgment before the Association.

Mr. CLUTE. In view of the remarks presented by Mr. Scott, I am inclined to think that some action ought to be taken. I would suggest that the executive committee take charge of this matter supplemented with another name which I have mentioned. I move therefore to amend the motion of Mr. Scott, that the words "special committee" be struck out and the words "executive committee" be inserted, to which should be added the name of Mr. Scott.

Mr. ROBERTS. May I ask would it be in order for the chief clerk to give us some light on this subject as to the specific reasons why the reports are not satisfactory, if not out of order, so that we may understand more fully the difficulties met with at his office?

The PRESIDING OFFICER. We will be pleased to hear from the gentleman from the Department of the Interior.

Mr. HOLCOMBE. In this discussion I had proposed avoiding going into particulars or details, but I am able to give a few points. First of all I would say that dissatisfaction with this form of schedule was brought to our notice at the office by the treasurers themselves. I remember several very excellent letters from treasurers on this subject, one from Ohio, one from Nebraska, and a number of others which I do not recall at this moment. Treasurers generally find the difficulty mentioned by Mr. Scott in the proper classification of particular articles, which seems to show that these schedules are not adapted exactly to any convenient system of bookkeeping.

Now Mr. Porter referred to a conversation between the Commissioner of Education and the committee of which he was a member. I would beg the convention to remember that at this time the subject was entirely new to the Commissioner as well as to the consulting committee, and the Commissioner should not be held strictly to anything he said at that time. Most of the points which were brought out in that conference, however, the Commissioner committed to writing and printed in various circular letters sent out from time to time.

Let me say that in my opinion this form of account would not stand the test if applied by higher authority of the Secretary of the Interior himself. I mean that the act of Congress requires a detailed statement of expenditure. Now some Secretary with less confidence in the Commissioner of Education than the present one might appear on the scene and call for an exhibit of these reports and say, what articles do you suppose have been purchased under this head, stock and material, what articles under machinery and apparatus, and so forth and so on?

The Commissioner of course will have to say that that matter is left entirely to the treasurers and presidents of the institutions. That may not satisfy the Secretary of the Interior at all and there might possibly be some trouble on that account. I suggest this as possible, though I scarcely think it probable. Yet it would seem that there must be some tribunal to whom to refer questions as to what are proper expenditures. The Commissioner of Education has received many inquiries of that kind. Some interesting matters have come up in these reports, some rather amusing ones. Some gentlemen wanted to know why the Commissioner spoke of mistakes in statements in one of his circular letters. It was from the fact that a board of trustees of a certain college insisted upon purchasing a piano from this fund. The Commissioner held that he did not consider a piano a facility for instruction in any of the subjects enumerated in the act. The president of the institution had been of that opinion beforehand and expressed great satisfaction that the Commissioner of Education took that view of the matter. This is merely an illustration. Suppose the president of that institution, instead of corresponding with the Commissioner about the piano at all, had merely in his innocence said a piano is a facility for instruction in physics under the head perhaps of acoustics, the Department would never have known anything about the purchase of the piano. But if in any way the matter had become known, it would have caused trouble. These are merely illustrations of the point taken by the Bureau of Education, and I feel more at liberty to bring the subject before you from the fact that so many treasurers have expressed dissatisfaction with the present form of schedule.

Mr. HUNT. I would like to suggest to Mr. Atherton a point against referring this to the executive committee, and I do this because the secretary of our board of trustees would be here to-night if there was not a meeting of the board of trustees in Columbus to discuss this very question, and he asked me to present his views. I will have to speak frankly about it. There is need of a great change in this matter. Mr. Holcombe has mentioned receiving a letter from me on the subject. This question should be discussed by bookkeepers. A committee should be appointed of men making a special business of these matters and it seems to me that some such committee should be appointed, and I will say that if Mr. Scott had not made this motion it was my intention to do so. There are men in many of the institutions who have been there for the last twenty years and doing nothing else but making these accounts. They see things often that the college presidents overlook, and I think they would make more suggestions to the Bureau of Education because of this very fact. Our secretary wished me to make these suggestions to the convention.

Mr. ALVORD. There are two points to be considered in this question. In the first place when the present schedule was adopted, both sides in the conference between the Bureau of Education and the committee

agreed that it should be decided what was meant by the word "detailed" in the law, and there was unanimity of opinion and perfect accord on that point. There were present at that conference men who were thoroughly conversant with the system of accounts of college treasurers in every detail, and experienced in keeping such accounts. So much for the committee that brought the matter into this present shape. Now in regard to the revision. While I can speak only as an individual, the executive committee, gentlemen, has enough to do without seeking any further employment. If this motion prevails, I want to call attention to the fact that Presidents Broun and Goodell, and Director Neilson (who is treasurer of Rutgers College, of which Mr. Scott is president), are members of the executive committee.

Mr. ATHERTON. A word merely. I have no thought but the best way of getting at the desired result. If we feel as Mr. Hunt, that the committee should consist of bookkeepers, I would be glad to have the bookkeepers bring the result into the Association. My only thought is to get at the consensus of opinion so that when we make a change we will make a well-considered one. My individual judgment about such matters is that it is better to keep things of this kind in the hands of one committee, for the double reasons that we get the accumulated results of their experience, and secondly, officers of the Government come to recognize certain men as having a continuous representative quality and so deal more freely with them. You know how it is when you meet a man the first time—you take his measure as to how you will deal with him. I think it best to keep this in the hands of the executive committee with the understanding that the committee is to proceed very slowly and give results by correspondence or otherwise before taking any definite action.

Mr. TURNER. I think we may get a little practical information on this matter as we go along. The law requires that we should send a detailed report to the Secretary of the Interior. I would like to know whether the Department contemplates that when I give to a professor of chemistry $500 for books used in his department every book is to be itemized in his report. Is that contemplated? I suppose there are 2,500 or 3,000 volumes in our library this year. If every book is itemized, and of course that is the only way the Department can know about the items, it will be an enormous work to be printed. I would like to know if it is to be carried to that extent. I will state how we do it. I have assigned to each professor so much money and each one sends in a list of books desired. The list is carefully revised and any book not coming under the scope of this bill is struck out. The list is marked and sent to the purchasing firm, and this list is returned so that there is no chance of a book being charged to the wrong account. But if all these should be itemized, it would be an enormous work.

Mr. NEAL, of Oklahoma. Another point I would like to make. I suppose our legislators when framing the bill organizing the college

were not very well posted in college matters. They have made a board of directors without assigning to the president of the board any salary. We have no funds except what we get from the Morrill bill, and have no salary to pay him. Another thing, we have a secretary and treasurer to be paid out of the Morrill fund. Where in the schedule shall we place their salaries?

Mr. HADLEY. I have been trying to get to say substantially the same thing. I suppose we will all consider that the prerogative of preparing forms for this report belongs to the Department of the Interior. The Department of the Interior is responsible for the distribution of this fund and I think it is equally clear from what has been said this evening in our own individual experiences that there is a difficulty in satisfactorily filling the blanks as now constituted. Therefore it seems to me that the proper thing for this body to do is simply to appoint a committee who shall stand in readiness to represent this Association in conference with the Department of the Interior if their services are invited, but not otherwise. That is just the way I feel about it.

Mr. WASHBURN. The Department of the Interior understands this matter to a certain extent and our executive committee is amply able to explain all these points. Therefore I move you that this be put into the hands of the executive committee.

The PRESIDING OFFICER. The motion is to refer this matter to the executive committee and have them take charge of it.

The motion was carried.

The question is now upon the original resolution.

The resolution was adopted and the matter left in the hands of the executive committee.

The PRESIDING OFFICER. The general subject is still before you—the relations of the colleges to the Department of the Interior.

Mr. SMART. I was a member of the committee to confer with the Department, and it was a most fortunate thing, gentlemen, for us that the Secretary of the Interior placed the matter in the hands of the Commissioner of Education. Perhaps Mr. Alvord has told you of it, but I will tell you again. It took a great deal of time and a great deal of pains to assist us, and I believe that the Commissioner of Education and his chief clerk are both entitled to our hearty thanks. I will not make a motion. I know that the mere suggestion of it will raise a response in the minds of those who know anything about it to give them our hearty thanks for what they have done. [Applause.]

Mr. FERNALD. I desire to make an inquiry. Under the act of 1862 we are in duty bound to make a report and send to the Department of the Interior. My question is, whether that covers the requirement upon the president of the college, or whether he should write out a separate report of the same matter to satisfy the provisions of the act of 1890, taken from the published reports.

Mr. HOLCOMBE. It is a close point, but I should say that one report is amply sufficient. Each separate act requires that the report shall be presented to the Secretary of the Interior, but one report would certainly be sufficient.

Mr. ATHERTON. Yet the Commissioner calls upon us for a second one.

Mr. SMART. This Morrill act requires a report of experiment work. It is a difficult thing to make a report covering experiment work practically duplicated in the station report to your Department. I want to ask whether or not the station report may be sufficient, whether that will be accepted or not.

Mr. FAIRCHILD. The law of 1862 requires that we report to the governor of the State and send to the Commissioner of Education two copies of that report. Then the law of 1890 requires that we report directly to the Secretary of the Interior and to the Secretary of Agriculture before a certain date. Now, most of us are required to make an annual report to the governor according to the laws of the States before the date on which we report to the Secretary of Agriculture and the Secretary of the Interior, the 1st of September.

I would like for this committee in conference with the Secretary of the Interior to determine this point. We have found the reports accumulating upon us from year to year, and it is almost impossible to keep track of them. Last year I made a full report to the Secretary of the Interior as to the expenditure of experiment station funds. I had already reported from the experiment station in full, according to the Hatch act of 1887, and was notified in last March or April that no report had been received in regard to the expenditure of experiment station funds. Of course it was my fault. I should have sent that other report at the same time. If they can take that into consideration I should like it very much.

I move, Mr. President, that the executive committee be requested to confer with the Secretary of the Interior with reference to a complete arrangement of the required reports of all the departments of the college, including the station.

The motion was carried.

The PRESIDING OFFICER. Is there anything further on the question? It is still open for discussion.

Mr. HADLEY. Inasmuch as we want to leave early to-morrow morning, I move that we adjourn as soon as the necessary announcements have been made.

Mr. ALVORD. I have a resolution which I am instructed by the executive committee to offer at the close of this discussion. Before doing so, I beg leave to say a few words on this general subject. I will simply refer to the cordial relations which have existed all along between the Secretary of the Interior and the Commissioner of Education in our mutual work under the act of 1890. Yet there has been one point on which I have radically differed with the decisions of the Department

and shall continue to do so, and believe the time will come when the decision of the Department on that subject will be reversed. The Department has declared under the act of 1890 that it was its prerogative to determine the division of funds under the Morrill act whenever under that law they were to be divided in any State. That has been the ruling, and under that ruling the act has thus far been administered. As a result, one State in this Union has not received any benefits under that act. The State of South Carolina, true to her general principles, believed that it was her prerogative to decide as to the division of the funds under that act, and has never reached any agreement with the Secretary of the Interior; consequently it has received no money under the Morrill act and has been so reported to Congress. In this one instance (and I desire to emphasize this) I believe South Carolina to be right in the position she has taken. I sat in the gallery of the Senate of the United States on a certain Monday morning prior to the passage of the Morrill bill. During a very close discussion, and just before the vote was to be taken, the Senator from Louisiana, Mr. Gibson, asked of Senator Morrill: "Do I understand, sir, as a result of this compromise, that it is left to the legislatures of the several States to determine how this fund shall be divided, if it is divided within the State, under the provisions of the act?" Mr. Morrill replied, "That is the amendment which I now offer to the bill." Then about an hour's discussion followed upon verbal amendments to the bill. When they were just about to take the final vote on the bill, Senator Cullom entered the Senate Chamber for the first time that day. He asked the stage of proceedings on the bill, and when told turned to Senator Morrill and asked almost the identical question put by Senator Gibson—whether the ultimate disposition of this fund rested with the Secretary of the Interior or the legislatures of the several States. Senator Morrill replied that it was left to the legislatures of the States respectively. Senator Cullom said, "That is not as I would have it, but I will interpose no objection now." The bill was then passed. Turn to the Congressional Record and you will find this substantially as I have said. There is no question as to the intention of the Senate of the United States and the point was not raised in the House. I believe that the ruling of the Secretary of the Interior is wrong, and I believe that the act entitles each State to decide under the act of 1890, and I trust the time will come when the act of 1890 will be interpreted in this respect as liberally as the act of 1862. While I have held adversely upon this point, I nevertheless have recognized that the best thing was to get the act generally into operation as soon as possible.

Mr. HOLCOMBE. I would like to call Maj. Alvord's attention to the fact that a special act has been recently passed by Congress authorizing the Treasury to pay to South Carolina the three installments due, notwithstanding the ruling of the Secretary of the Interior. The decision of the Department of the Interior has therefore been reversed on that matter.

Mr. ALVORD. I now offer the following resolution from the executive committee and move its adoption:

Whereas we recognize the great and increasing usefulness of the Office of Experiment Stations of the Department of Agriculture, in promoting the interests and efficiency of the experiment stations, under the act of March 2, 1887; and

Whereas a large and increasing burden has been placed upon the Department of the Interior and the Bureau of Education in consequence of the act of August 2, 1890, known as the second Morrill act;

Resolved, That while we recognize the cordial efforts of the Secretary of the Interior and the Commissioner of Education to administer that law so as to secure the highest benefits to the institutions affected, we earnestly request Congress to make adequate provision for the best administration of the additional duties placed upon the Department in consequence of the passage of this act.

Adopted.

Mr. ALVORD. It is understood under action already taken no more business shall be transacted at this general convention except to hear and act upon the report of the committee on acknowledgments and courtesies to-morrow evening.

The Association then adjourned at 10:20 p. m.

EVENING SESSION, FRIDAY, NOVEMBER 18, 1892.

The meeting was called to order at 8:40 o'clock by the chairman of the executive committee in Parlor P of the St. Charles Hotel.

On motion of Mr. Armsby, Mr Alvord was elected to preside over the session.

Mr. Stubbs introduced Mr. Higgins, proprietor of one of the large rice mills of the city, who cordially invited the members to visit his mills on Saturday morning before leaving the city, stating that it would not take over an hour and a half, allowing plenty of time for the early morning trains.

A census being taken as to the number desiring to go it was found that there were twenty-five. Mr. Higgins then said that he would be glad to have carriages at the hotel to take those desiring to go to the mills.

Mr. Atherton moved that the hour be 8:30, prompt, so that they would have time to catch the 11 o'clock train.

Carried.

Mr. Atherton then made a few remarks expressing the thanks of the Association for the many courtesies shown by the organizations of New Orleans, referring especially to the Southern University, and moved that a vote of thanks be extended to the officers of that institution.

Carried.

The presiding officer then called for the report of the committee on acknowledgments and courtesies.

Mr. Morrow reported the following resolutions:

The number and variety of the courtesies shown the Association which have made this meeting one of the most enjoyable in its history, make it impracticable to pro-

perly characterize and particularize each, and your committee can only make a bare mention of them.

It therefore reports that the thanks of the Association are due and tendered to the following transportation organizations:

The Trunk Line Association; the Central Traffic Association; the Southern Passenger Association; the Boston Passenger Association; the Chicago and Alton Railroad Company; and the Illinois Central Railroad Company for reduction of fare to delegates, and especially to the Illinois Central Railroad, to Capt. J. F. Merry, and others of its representatives, for the excursion to Baton Rouge, and personal attention in many ways.

Also to the local committee of arrangements, and citizens of New Orleans, for the excellent arrangements, especially mentioning the chairman of the committee, Prof. Stubbs. To the officers and faculty of Tulane University for the use of its halls and facilities for the meetings of the Associations. To the Literary and Social Clubs and Commercial exchanges of the city, and to President Nicholson and the faculty and officers of the Louisiana State University and Agricultural and Mechanical College for their hospitality at Baton Rouge. To the press of the city for its unusually full and accurate reports of the proceedings.

To Mr. Higgins for the cordial invitation to visit the rice mills of the city.

To the proprietors of the various sugarhouses visited on the excursion to Baton Rouge.

G. E. Morrow,
Austin Scott,
H. W. Wiley,
Committee.

Mr. Smart, on behalf of Purdue University and other Northern institutions, extended an invitation to the Southern delegates to make them a visit on their way to or from the World's Fair.

The secretary then presented the following communication from the Iowa Agricultural College inviting the Association to hold their convention at Ames, Iowa, next year.

Secretary Association of Agricultural Colleges and Experiment Stations:

The faculty of the Iowa Agricultural College and the experiment station instructed their delegates to invite the Association to meet at the Iowa Agricultural College in 1893.

Respectfully,

Herbert Osborn.
L. H. Pammel.

The communication was referred to the executive committee.

The following resolution was offered by Mr. Goodell and seconded by Mr. Harris. Mr. Atherton made a few remarks, calling on the members of the Association to extend their support to this journal. The resolution was as follows and was unanimously adopted:

Resolved, That this Association, recognizing the importance of having a means of publishing nonofficially and promptly the results of agricultural investigation, and appreciating the value of "Agricultural Science" to all interests in that field, desires to commend that journal to the cordial support of all members of the Association and to the public generally.

Mr. Harris. I would like to say that the great delay in sending out card indexes prepared by the Office of Experiment Stations has been on

account of difficulty in getting the cards printed. This difficulty I believe is about to be surmounted, and I expect in the very near future to send the cards out quite rapidly. As soon as we receive the first batch from the Government Printing Office I expect to issue a circular in regard to the sale of the cards.

Mr. Cavitt, secretary of the board of trustees of the Texas Agricultural and Mechanical College, on behalf of that institution extended to the Association an invitation to hold their next meeting in Texas.

Mr. Miller, of the Maryland station, presented the regrets of President Silvester, saying that he had expected to come up to the last moment, when he found it impossible.

Mr. Alvord stated that several communications of like nature had been received by the executive committee from President Northrop, of Minnesota, President Stockbridge, of North Dakota, and President Walker, of the Massachusetts Institute of Technology.

It was then moved that the meeting adjourn *sine die*.

Mr. Alvord said that before putting the motion for adjournment he wished to express his gratification at the attendance and the work accomplished by this convention. It was the most successful in the history of the Association.

The motion being put, the Association adjourned *sine die*.

APPENDIX.

MINUTES OF THE SECTIONS.

THE SECTION ON AGRICULTURE AND CHEMISTRY.

The section on agriculture and chemistry held four sessions, as follows: At Tulane University, 7:45 p. m., November 15; 10:30 a. m., November 16, and 8:30 a. m., November 17; and at St. Charles Hotel, 6 p. m., November 17.

The first three sessions were presided over by Chairman Ingersoll and the last one by Chairman-elect Henry. There were seventy persons present at the second session, sixty at the third, and fifteen at the fourth.

On motion, Mr. Curtis of Texas, Mr. Gulley of Arizona, and Mr. Cooke of Vermont were appointed a committee of three to take charge of the program during the meeting.

On motion of Mr. Cooke, of Vermont, the section on chemistry was invited to meet with the section on agriculture.

On motion, Mr. Quick of Colorado, Mr. Thorne of Ohio, Mr. Georgeson of Kansas, Mr. Vanderford of Tennessee, and Mr. Roberts of New York were appointed a committee to report nominations for chairman, vice-chairman, and secretary.

The committee reported as follows: Mr. Henry, of Wisconsin, chairman; Mr. Stubbs, of Louisiana, vice-chairman; and Mr. Latta, of Indiana, secretary.

The report was accepted and referred to the general association for confirmation.

The following papers were read before the section:

Grass gardens—methods and purposes. By W. M. Hays.

Advances in farmer education. By W. M. Hays.

What should the professor of agriculture teach? By G. E. Morrow.

What should the professor of agriculture teach? By P. M. Harwood.

Grasses for the semi-arid region. By C. C. Georgeson.

The field of bulletins, present and prospective. By C. L. Ingersoll.

The physical tests of soils. By R. H. Loughridge.

The establishment of official methods of experimentation. By F. A. Gulley.

On motion of Mr. Scovell, of Kentucky, the paper by Mr. Loughridge was referred to the Association of Official Chemists for a comparison of the methods therein discussed.

On motion, it was decided that persons having papers prepared, but who were unable to present them on account of the lack of time, should hand them to the secretary for transmission to the committee on publication.

The following papers were thus received and referred:
What is the live weight of an animal? By H. J. Patterson.
Stock-breeding at experiment stations. By W. H. Brewer.
Methods of irrigation. By L. G. Carpenter.
The press bulletin. By C. E. Thorne.
Fiber production. By Charles R. Dodge.

Grass Gardens—Methods and Purposes.

By W. M. Hays, *of North Dakota.*

The purposes of grass gardens on experiment farms may be named under several heads:

(1) The teacher who has students interested in agriculture, and can have their attention while grasses are growing and fruiting, needs small plots of all the economic grasses, clovers, and other forage plants, where he can require each student to make himself familiar with their economic and botanical characters. Not a little of the much needed concrete teaching of practical things can be accomplished along this line by the energetic teacher. Such work as requiring each student to keep notes on one or more plats of grasses or clovers during one or more seasons would be of use to the boy when he becomes a farmer. The student who learns to compare the yields, time of ripening, fighting proclivities, methods of seeding, and other economic features of the most useful grasses of his State, by observing them in adjacent plots and especially by systematically recording notes on them, has a most useful fund of information. It is a kind of training almost as hard to get by means of lectures and text books alone as it would be to become a chemist without laboratory practice. A student thus trained is able to treat field conditions on the farm from the standpoint of technical knowledge. At the north there is a serious obstacle presented to the above plan. The plants in question nearly all flower and mature while the students are away from the colleges during the summer vacation. Students should all be expected to preserve botanical specimens of all economic forage plants suited to their State and garden plots will greatly assist them.

(2) Whoever carries that part of the teaching which relates to the cultivation of crops, their rotation, management and thus keeping up the fertility of the fields needs to have charge of and require himself to keep notes on plats of forage crops. The teacher of general agriculture in those Western States where mixed farming is practiced and much live stock is kept especially needs to keep himself posted along this line. The teacher who will do this work and by traveling, inquiring, answering questions and in every possible way try to become expert in the management of pasture and meadow crops, will be able to make himself as well appreciated as the professor who, by becoming an expert in live stock, gains the confidence of the stock-raisers.

(3) The grass garden furnishes the place and methods for testing foreign or new varieties of annual and perennial forage crops in a less expensive way than would be possible in field plats. Promising things alone need be taken to the field to give them actual trial in the economy of the farm, or distributed to farmers and others who will coöperate.

(4) Preliminary tests of grass mixtures can be carried on in comparatively small plats. These can be planted in duplicate and thus tested under the different conditions furnished by sowing at different times in the season, in different seasons, on different soils, on lands differently prepared, sowing with or without another crop, covering the seed in different ways, with and without top dressing. Under all these conditions the power of each perennial variety can be studied as to its length of life, its power to hold its own in competition with all others, the amount of and proportion of forage produced by each plant in the various conditions, and in the various

mixtures. The lessons the careful experimenter will gather while systematically keeping notes of a series of plots are without number. He may get many weights of products which will give him a basis for formal reports, and he will learn the general facts and laws governing rational practice in the region for which he labors. The most successful plans can be extended to field and coöperative tests or possibly recommended for trial by farmers.

(5) Probably the most important work to be carried on in the grass garden is that of the improvement of the standard grasses and clovers which are of such immense importance in our agriculture. No one thinks strange that pansy fanciers and propagators go to the trouble to improve pansies that they may have rich and novel combinations of colors. But who has even carefully studied out the variation in the plants of timothy or red clover or other varieties upon which so many of our people depend for sustenance and means of obtaining the enjoyments of life. Who can tell us as to whether material improvements can easily be obtained by simply selecting the best plants of timothy for a number of generations. Who among us is really reaping for the farmers the fruits of the seed sown and the harvests of fame made possible by the great work of Charles Darwin. He showed us how by crossing plants carrying distinct blood lines yet close enough to unite that we could increase productiveness and by selecting desirable variations we can secure sorts which better suit our needs. We are not keeping apace with our horticultural brethren who are cross-fertilizing apples, grapes, strawberries, and many other classes of plants.

A few other facts as to methods of work in the grass garden may be classed as follows:

(1) The size of plats to lay out for varieties must be determined by the purpose in mind. Plats 1 or 2 yards square with alleyways 2 to 3 feet wide are suited to the purpose of the botanical study of species, and on these small plats many practical questions as of annual or perennial habit, ability to withstand the encroachment of neighborly species, or the time of season when the main growth of pasturage is produced. Plats 20 by 20 or 20 by 40 feet, in which 1 or 2 square rods can be harvested without taking the border, is a good size to study yields, as weights can then be at once taken on portable scales. All plats for this purpose must have duplicates, the number depending upon the uniformity of the land, care in producing and planting the seed, etc. Plats of this size will also do for experiments in comparing grass mixtures, though larger ones for all but preliminary trials are advisable. Perennial plants should be so distributed in the plots that those nearly alike are not on adjacent plats, as mixing will thus be a less vexatious matter. Planting in close rows instead of broadcast is conducive to economy, ease of weeding, and ease of keeping from mixture of kinds where not desired. This plan is sometimes objectionable, as it gives the plants unusual conditions.

(2) Where sown in drills small plats can be weeded as long as is needed the first season. Where sown broadcast all but very rank growers can be insured a better chance than they would have in field practice by mowing the weeds occasionally at a height of about 3 or 4 inches. For some purposes it is wise to sow the plats to wheat or other grain and then seed the grass before or after the last harrowing, or in early spring with winter grain, as is the custom in field practice. Some stubble, aftermath, or even weeds, is ofttimes a good winter snow gatherer and protection.

(3) A complete history should be kept of the plat. Source and quality of seed, previous treatment, preparation and character of soil, time and manner of planting and amount of seed, time of coming up and fullness of stand, and favorable or unfavorable weather, are all parts of the plat history to be recorded the first month or two. Changes in stand of plants and their cause of decrease, development as observed at stated times, time of flowering and seeding, when large enough for pasture in spring, whether annual or perennial, time harvested, green weight and dry weight per acre, time aftermath is ready for pasture, relative amount of fall pasture, time it succumbs to frosts as compared with some standard as red clover, etc., etc. I have

kept grass plat records by giving to each plat one or more pages in a note book and write into this the notes as made in the field. The facts are then all in chronological order when the plot has run its course, or at any time they are needed for study or report. Having the previous history before the eye at the time of making additional notes is a help. Note books of tinted paper are less severe on the eyes for taking notes in the sun.

(4) The first thing to be done in taking hold of a variety to improve it is to study the plant's method of reproduction, as to whether close fertilized, its variation in such economic features as size, earliness, yield of seed, ability to spread rapidly by stooling, if a grass, as to whether long or short lived in those like clover, which are little better than biennial in habit. I have a variety of timothy started with which I am much pleased, both because it promises to be good foundation stock upon which to work by means of selection in the production of larger yielding varieties, and because the distinguishing mark found in the sport I started with seems easy to perpetuate and fix as a permanent variety mark. The spikes are branched, having on either of two sides several spikelets which stand out one-quarter inch or more, being that much longer than the other spikelets. I have also white flowered *Trifolium pratense* raised from the white sports often seen in fields of red clover which promises to serve as an excellent foundation stock from which to develop varieties of clover by selecting for intrinsic qualities, at the same time making the unusual color a distinguishing mark. In the case of clover cross fertilization and selection can be taken advantage of as well as improvement by selection alone. Timothy flowers are rather small for the patience of the ordinary man to try to cross them artificially, though not impossible.

Advances in Agricultural Education.

By W. M. Hays, *of North Dakota.*

The country district school furnishes the bulk of the school education of the rural youth. By attending for a year, more or less, at our excellent city high schools, academies, colleges, and universities many of those who continue to reside on farms receive further school education and culture and gain many technical facts useful in their lives and business. Our whole systems of secondary and higher institutions of learning are in fact doing an immense work in educating farmers as well as other classes. The influence of the literature of books and periodicals and of public speaking and of private discussion are wonderful factors in moving forward the powerful mind forces of our agricultural people.

Technical farmer education took on form in periodicals and in speech making and with the land grant of 1862 in schools. These journals have grown into hundreds of general and class papers, with the fifty experiment stations making copy for them. They have also a constituency of agricultural specialists, who supply a never-ending stream of useful facts. We may have too many papers; but, as with cattle, when there is a surplus it is the scrubs which must go, even if by means of score card and record the farmers must find means of making a division. We need more editors and more publishers who have an agricultural college education. All here have little need of a recital of the way most agricultural colleges started with their course of study more scientific than was found in literary colleges, and with a minor amount of agricultural subject-matter. The science was generally well taught and was popular with the students in these colleges. Most of the men who taught agriculture had never learned the business of teaching in these lines, and whether they were scientists merely, simple practical men of farm affairs, or even in some cases where they had good qualifications, as things then were, in both science and practice, they pretty generally found a great load to carry, or even could not see far enough to find the load that should be carried. In too many cases students found that agricultural subjects were not taught in a manner to fully satisfy them.

The agricultural technique in these early attempts was often left to one man, as much through his fault as that of the teacher of mathematics, who may have had a needed assistant. The poor professor of agriculture struggled on, carrying instruction in live stock, dairying, soils, crops, horticulture, forestry, veterinary, and if really unlucky he consented to take botany and entomology also. The man who tries to carry even a few of the most allied of these lines has not the highest success in really educating his students. The plan being carried out by the Wisconsin, Michigan, and other schools, where there is a specialist in each of the several divisions, of what the professor of agriculture was formerly expected to teach, seems wise and brings results when practiced in school work and in station work as well.

These colleges have been successful scientific institutions from the start, but their evolution into schools of agricultural technique and practice has proven a longer and more painful operation than was dreamed of in the start. Some institutions are on a better basis than others, in that they have one or several successful features worked out under their own experience, and in their own way. Since the experiment station fund increased the study of the technicalities of practical farm affairs, there has been a general division of labor and increased interest, which has resulted in much experimenting and upbuilding along the lines of arrangement of course study, and of the subject matter taught by teachers in lines generally allotted to the agricultural department or division in the colleges. There is a strong disposition and effort everywhere to not only thoroughly prepare a lot of men well equipped for professional agricultural men, but to secure students who will return to farms, and to give them a training for their future business that will simply lead them on and not away from the farm. We have no one institution to which we can point as a model for other States, or even for its own State. We can, however, point to some rather new features in various institutions which are apparently very valuable experiments, often successful ones. We have new arrangements of courses of study, like the dairy schools of Wisconsin are, in Minnesota and other States. Short winter or farmers' lecture courses, the school of agriculture, as in Minnesota and Missouri, and doubtless other rearrangements more or less supplemental to the original straight four years' college course. These experimental courses and schools have grown up to meet a demand coming from the people, or a dire necessity on the part of the institution to accomplish something, and are of far greater moment than many experiments in our stations.

The agriculturist's work, so far as what he shall teach, and how he shall teach it, depends much upon the class of students he has, and what they are expected to do with their training. It is not the main duty of a college and its professors of agriculture in a given State to make, by encouragement and special instruction, a lot of agriculturists, dairy teachers' and live-stock instructors for the home institution and those of other States, though that is a very important secondary line. The main great duty from this on of the division of the work his department represents is, I believe, to educate young men who will farm and become models for their neighbors and teachers of others. Thirty per cent of those who enter is enough to have choose other professions than farming. These colleges of necessity had to educate men to be teachers and experimenters during their earlier history, and greatly to be honored are these States which have sent out in other States so many useful men. The production of these men must be continued, but hardly as the over-topping object of each institution. These men who are fitted as specialists are largely a means to the two ends of teaching and experimenting, and we must depend upon this class largely for the men who, by experimental research, shall develop and broaden the sciences of agriculture.

The other purpose of the college is to give to the would-be farmers education in the farming business. I realize that I have taken radical ground, but the change wrought in Minnesota by a school experiment heroically tried there has converted me into this belief. Dr. Porter, who helped start the idea and movement there, has

so much faith in it that I see he is developing a similar school in Missouri. The two years' school of agriculture course in Minnesota, instead of degrading education, has become the pet of the farmers of the State; and the faculty and students of the collegiate department of the university of which it is a part are also proud of it. It is a school to meet a certain purpose, and it fills the place for the young man who will be a farmer much as does the high school, the business college, or even a law school for the general business man or the lawyer. So the dairy course and the farmer's winter course fulfills each its distinctive purpose for some dairymen and farmers who want to attend the school only for a short time, as does also the college course meet the wants of the young man who wants the broader culture of a college course before taking up the management of his farm, or the one who wants to pursue the professional work in agriculture.

To really carry out the suggestions above made, that we come down from our high perch and teach the farmer what he wants, not a little depends upon the several men who teach the division usually distinguished as agriculture, including, of course, horticulture. Young men who have grown up into practical farmers, who keep in touch with the work at home during vacations, and who are at the school largely as a business venture, count largely upon what they get in this division to help them in their work when they go back to the farm, and many of our former short-course students have confirmed the truthfulness of the above assertion by so stating a few years after their return to their business. There is great inspiration, too, to the teacher who gets close to these boys' lives and purposes in the questions and pointers they will give in class and when working at practicums; also when they return after a year or more on the farm since leaving the school.

We have no one institution to which we can point as a model for others to follow. What would be best in one State would hardly fit any other. But we now have ample examples of successful features of various colleges from which any institution not in satisfactory condition can select patterns with which to add to or reconstruct an almost model institution in each State; and further experiments that must result when we supplement the four years' course will add more successful features from which each institution may select. True we have not had enough men who have had successful experience in the various technical lines to man so many model institutions with model teachers, but these men are rapidly being made. The raw material comes generally in full stature from the farm, and are being molded by special courses and secondary courses, dressed by collegiate and graduate courses, and kiln-burned to a finish in the useful function of assistant college and station workers. Some of them stop underdone; others come out overcooked, cracked, or warped, but there will be sufficient of the true-rounded cylindrical-shaped who will fit together, and through which the clear, filtered stream of agricultural thought will run from the soil to the spring where the farmer can drink from the crystal fountain of knowledge.

A review of the present development and differentiation is in order. Colleges like that in Wisconsin have grown from the one-professor idea to a position where a dozen or more men work in as many lines which apply to practical agriculture. These men leave to other college or university departments the general fields of science. Even the lines of agricultural chemistry and agricultural physics are there being more or less divided to separate men, and two or more men represent as many parts of dairy manufacturing, and as many more dairy stock. Close division of labor all along the line is absolutely necessary. These close specialists are bound to make their work go. They will evolve text-books, methods of practicums, and other indispensable machinery of farmers' educational work.

The several purposes now being looked at in one or all the many colleges may be classed under the following heads:

(1) The general education of men, because they are men.

(2) The advancement of sciences which underlie industrial education. The Government assisted the States to make provision for these general classes of work

elsewhere. Agricultural college funds are nowhere sufficient to carry even agricultural work and that in mechanics, which rightfully belong to these institutions. If we can get talent to profitably use the funds to help people, part of whom will return to their industries, there is where most of the money belongs. Much, however, has been done along these wider lines of education.

(3) Technical science, the object of which is to amass facts and develop appliances and men who shall work along industrial lines, I place in this class.

(4) In the fourth class I place special schools, as of dairying, practical mechanics, veterinary, domestic economy, etc.

(5) In the fifth class I place the schools of agriculture and short courses, which are adapted to the wants of the young men and young women who want an education of the high school, academy, or business college grade before settling down on the farm. These last-named schools fit most of our business men for life, as do the schools of medicine prepare doctors; and schools for farming, not necessarily schools for professors, will likewise fit our farmers to keep up with the agricultural procession of their generation, and it is nearing the two-minute gait.

(6) In the sixth class I place farmers' institute and allied work as a most valuable part of the college. Here facts can be given the farmer interested in the broader, more complete work of the school courses.

(7) Possibly some organized attempt would attach rural district schools in some way to schools of agriculture. This might allow of some agricultural lessons to be taught in country schools, and some stimulus to make the country school prominent as a stepping stone or leading string into these agricultural schools of a secondary grade.

If we fill up our schools of a secondary class and there present a course of study of which the returning farm boy will speak in the highest terms to his neighbor youths, we will find plenty of students interested in getting on a better basis before settling down at farming. You might even get so many of these short-course graduate students that those who would continue in the college course, plus those who now enter from high schools, would far outnumber your present number of college students and graduate students. You thus increase the popularity of the college course and besides do the work that farmers would now at once demand you must do if they thought you could do it. That boys can be taught much of how to live in a two-year course, as well as much technical knowledge, I have seen as clearly demonstrated in the case of students in Minnesota as I have learned that many colleges lead from the farm.

INTRODUCING NEW FEATURES.

So far as the immediate school education of the to-be farmers was concerned, our colleges of necessity began at the wrong end. They did not well know what was wanted. The farmers generally agreed that schools as thorough as any needed by professional men must be supplied to farmers' sons, who of all men need and are worthy of a knowledge of many things. The school men who had charge of affairs naturally were ambitious to have high collegiate courses of study. In getting ready teachers and experimenters and in developing the science and education, they have done wonders. Several have made an especial effort to get as many men in other stations as possible, not always regarding quality as much as should have been done. It strikes me forcibly that we now have reached the point where a strong push can be made to turn part of these developed forces into channels which will bring hundreds of thousands of the future farmers into the popular systems of instruction in schools of agriculture.

The force of inertia, where conditions exist which seem stable, is the greatest obstacle. Votes and personal work of farmers have been tried successfully in some States. Should Prof. Henry, here, get into position to show and tell through the papers that he has 1,000 students in his short courses and that he had been asked by

the State to put up more buildings to accommodate more sons of the constituents of the State legislators, the farmers in other States would find it out and would see that similar plans were followed in their own institutions. The more natural way will be for the people in authority to master the new ways of doing things in the various institutions and adopt as rapidly as things adapted to their several States prove themselves of merit, or even really promising. Every college ought to be trying one or more of these experiments, and we would soon solve the great problem of how to have farmers who are educated in their business.

The things needed to make these ventures successful are faith, plans, courage, money, equipment, and men. Most of our colleges need double or treble their present income to make their work successful. Beet-sugar factories are not successful on a small scale. They must have a capital of $200,000, so that all parts can be built up in the most approved and best way. A few professors with a small equipment can not satisfy students, unless quality makes up for quantity. I once had a pet idea that a number of agricultural schools in each State would be far better than one college, but experience teaches that a large equipment is necessary.

Wisconsin and Minnesota stand very low in the record of the number of station workers and teachers they have turned out. But if you want to see the kind of men farmers want our colleges to turn out, go to Mower or Renville counties, in Minnesota, and find some of the graduates of the school of agriculture. If you want to see the kind of butter and cheese makers the farmers want produced to manufacture their dairy goods, go into many factories in Wisconsin and find men who have been at Madison. You will be able to find in the homes of this same class of farmers model wives, educated in the domestic-economy schools of agricultural colleges. What other class of institutions can or will take up the development of farm women's technical education, as well as domestic science for all classes of women? Science has been more tardy in helping agriculture than any other great industry, and even yet more tardy in helping woman in her work.

MINNESOTA'S EDUCATIONAL SYSTEM.

As there is no representative here of the School of Agriculture in Minnesota, I have been requested to make a statement of its plan. The agricultural college is a part of the university. While the university was struggling along during the earlier part of its history, there was little demand for the college course in agriculture. The wheel horses at the head in its management lost faith in the possibilities of agricultural education, and as every dollar told in other lines there was for a time a tendency to let the work sleep and not even have the one professor of agriculture. Pressure from without and a constant demand for separation caused the authorities to hunt for something practical to do. Prof. Porter was called to the institution and started a summer school of practice, but wanted something better. State Supt. Kerle, *ex officio* a member of the board of regents, was sent on a tour of inspection to the most successful colleges and university departments. Some things were learned at Guelph, Canada, as well as at other schools.

The farm in the city by the university had become very valuable real estate and was sold. A better farm 3 miles out and some good buildings were the returns from the sale of the first farm. On this farm the station corps was located, and a school of agriculture was started the same year, providing for a course of two winters of six months each. This was afterwards extended to three winters of six months each. The farm boy can do but little in Minnesota during the long, cold winter, and he can go there as cheaply as he can attend the local high school or go in society at home. Forty-five students were enrolled the first year. The next year we had 75 students, as I remember, and agriculture, horticulture, veterinary, dairying, live stock, and carpentry formed a large part of the instruction. The school, now in its fifth winter, will register considerably over 100, and would have been much larger if the employment of a greater number of teachers had made the instruc-

tion better along technical lines, more practicums provided, and other improvements earlier made. This school has now settled down to the plan of about one-half the students' time being occupied with common and high school studies and the other half the lines named above. Where a student is well up in general studies, he devotes his whole time to technical subjects and sooner completed the course. Great credit is due the principal, Mr. Pendergast, and his assistants, professional high-school teachers, who have taught the general studies and, living with the students in the dormitory, fostered the school and farm spirit, the spirit to make the school prepare for the farm life and work.

These young men are enthusiasts over the school. Most of them do not expect to go to the university, and, though bright, are boys most of whom would not be led through the usual high-school channels to get into the university or other college courses. They are mainly boys who have fully decided to make farming their business. Half a dozen of the fifty or sixty students who have finished this course have entered the college course, to which they are barely prepared to enter upon graduation from the school. Probably all but one of this number will hold to agriculture. All the other graduates, with possibly a few exceptions, have gone back to the farm or into an allied branch of farm business, as creamery management, nursery management, etc. The greater number of students who entered the school and took one winter's work, more or less, selecting out a lecture course, with possibly one or more other studies, have practically all returned to the farm. Of the agricultural college students, one is a junior, two are sophomores, and three are freshmen. They enter the freshmen university classes with somewhat less training than do the high-school graduates from Minnesota's excellent high schools, but with a prestige of practical acquirement and industrial importance that makes of them peers of their literary and scientific fellow students. These young men tell me that they are consistently and respectfully treated by all students. These men are all taking the agricultural, though others now in the school are expecting to enter the excellent mechanical college of which my friend here, Prof. Hall, is dean. They can enter any university four years' course from the school of agriculture.

The entire instruction of the students in the school is provided at the experiment farm, part by general teachers employed for that purpose alone and the technical part by the experiment station workers. The students in the four years' college course have all their general science, literature, etc., in the city in the regular university classes. Four terms, when they can best leave the regular classes, they move out to the experiment farm and spend their whole time receiving technical instruction from the experiment station workers. These college students, having gone through the school, have a great interest and pride in doing it every possible service and help to keep up the farm spirit. The policy of the teachers on the farm has not been to make any special effort to induce graduates of the school to take the college course. Occasionally a young man who seemed especially fitted to professional work was advised to take the advanced course with that in view.

ADVANTAGES SECURED.

Several things have been accomplished in Minnesota. First and best, expert farmers, horticulturists and dairy workers are put out as leaven in the State. Second, the farmers are interested, aroused and desirous, and more hopeful for more farm school education. Third, the institution has gotten into good repute, entirely revolutionizing public sentiment, and surely can secure money more freely. All this was helped by Supt. Gregg's farmers' institute. Fourth, the whole institution is alive to making agricultural education successful. The school of agriculture has brought the course in agriculture right down where the farmer boys can enter even from frontier counties, where school facilities have been meager. It has enabled the college to raise the collegiate standard for entrance, thus bridging over the gap between country schools to even a higher point than can be reached in the colleges in the

older States, where students come better prepared than in the West and South. It thus makes it possible to raise the standard of that important course which makes teachers and experimenters.

Several classes of students are here provided for. The man who wants a winter lecture course can select from the school of agriculture. Students who need to unite general school work and technical instruction can take part or all of the school course and even continue and take part or all of the college course.

Those who want to take up professional work take the school course and then the college course, thus putting in six years, not being able to get through without being well prepared, so far as school work can prepare a man to teach or experiment.

The Bulletin, Present and Prospective.

By C. L. Ingersoll, *of Nebraska.*

In opening a discussion of this subject it is done with hesitation, as I fear I am treading on ground that is dangerous; that some sensitive worker upon some of our stations will imagine that some well-directed remark was intended for him or for his station. However, the present bulletin of the average station may, to our notion, be much improved for the average farmer reader. We must remember first of all that of each issue quite a large number will very likely read a bulletin for the first time; therefore, as the first proposition, I would have—

(1) Simplicity: Let the whole description be clothed in simple language, and, when necessary to use a technical term, then in parenthesis give a very plain explanation for the benefit of all. Some bulletin-writers seem to have forgotten after two or three are prepared that they are progressing rapidly by their constant association with and study of experimental work, and that their constituents do not from the very necessities of the case go nearly so fast in the matter of improvement and education. This caution will apply to nearly every person who prepares bulletins.

(2) Completeness: Each bulletin should, in our opinion, be complete. Do not refer in a bulletin to three or four previous ones in a set. These bulletins may fall into the hands of those who only have the one before them or they may not have preserved the previous numbers. If necessary to completeness then, explain in as few words as possible the point alluded to, so that the reader may not turn away disappointed, having lacked in finding that which possibly gives a clew to the correct interpretation of all the rest.

(3) Graphic illustration: Whenever possible it is of great advantage to show relative values, yields, etc., in graphic form, so that at a glance one may see the general results, without searching through long tables of figures The same matter may be presented in other forms in the conclusion. The value of this arrangement can not be overestimated. Then, too, illustrations in the way of photo-engravings of matters of interest add very much to the accuracy of the information conveyed, as well as being of more than a passing interest to the reader.

(4) The conclusion: By all means have a well-digested conclusion, with the important points and figures well grouped, so as to make them easily remembered. The busy man has no time to look into the detail, but he will look over the conclusions you have reached and agree or differ with you in thought quickly. It is his way of doing business. The farmer, who, weary with his day's labor, sits down for a half hour in the evening, is in no mood to take up anything that needs much application; he soon tires of it, nods, and sleeps. But the brisk and brief conclusions of an experiment in which he has an interest he will read, and this may arouse a degree of interest sufficient to induce him to lay away the bulletin for more careful study and possibly for preservation. He may even caution the family not to touch that bulletin when they look for material with which to start the fire. All of these things have a bearing. Let us then spend time to make a careful and interesting digest of points grouped under the heading "Conclusion."

Will the persons receiving bulletins become educated so that the standard may be raised soon? We believe not. If we look in advance a period of ten years we do not believe that the average reader of bulletins will become educated so that the writer may use technical terms in chemistry, botany, horticulture, physics, and geology *ad libitum*, but we must constantly be on our guard, remembering for whom we write, for whom we labor.

The temptation of the scientist is to do something which will give him a name and a place in science, a reputation. It is a laudable ambition and we admire it; but at the same time it does not hinder our putting things in plain terms for the masses. Reserve our technical papers and researches for our associations for advancement of science, for the scientific magazines, and for our brother scientists generally. There are a few, however, who take the other side of the argument, and say that, if we make our bulletins simple and plain, ourselves and our work will be judged accordingly, but, if we put out learned bulletins, the people, not understanding the full purport, will rise up and say en masse: "What a smart man and what a learned production!" Persons may be found fulfilling all the conditions named and still others. These illustrations will suffice.

Of minor points we suggest a few, by way of emphasis only. The outside of the bulletin should have printed upon it the title, date, station, and all other data necessary for one to note at a glance all the facts connected with the issue.

For ourselves we would prefer to see the writer of the bulletin named upon the outside and not the director, president of the college, or other officer in charge. The station staff can be published on the last leaf or inside the cover. Then, too, the matter of numbering should be uniform. It has become beautifully diversified at present. It seems to us that if any one thing should come under the purveyance of the Department of Agriculture it should be the numbering and arranging of these in some uniform manner for future finding and reference, and the year 1893 would be an excellent time in which to begin the work. The form has not been uniform in size and shape, and the volumes, when bound, will present a heterogeneous collection. But these matters have been urged upon us from time to time, so that one need not go astray. The difficulty arose in the first place from each station starting out in its own way, and then each desired the others to come to its way of doing things.

The quality of paper in many instances is poor, and this detracts much from the value to the recipient. If it is on good paper, put up in good form, and is neat and attractive, it is liable to be preserved. If it is sent out on cheap paper, is poorly printed, and otherwise like a very cheap newspaper, it will be treated as all cheap circulars are treated; it will go to the waste-paper basket with scarcely a passing notice.

In conclusion, let us study carefully the problem of how to present the work of the stations in order to do the most good. The workers are as a rule conscientious, energetic, and are doing a large amount of work in the aggregate, in which 65,000,000 of people are interested. Nearly one-half are directly interested as agriculturists, stockmen, horticulturists, and gardeners. The others are indirectly interested in seeing the first half prosperous and happy.

Remembering this fact, then, gentlemen of this Association, let us strive earnestly to improve upon the work of the past; let 1893 be a year of marked progress in the bulletins of our agricultural experiment stations.

What Shall the Professor of Agriculture Teach?

By P. M. Harwood, *of Michigan.*

The position of the professor of agriculture is unique and is an extremely difficult one to fill. Not only is he called upon to perform the threefold duties of professor of agriculture, superintendent of the college farm, and agriculturist of the station, but the ground he has to cover in teaching is so large and of such diversified nature

that it can be treated only superficially at best and is more properly the work of several men, each an expert in his own department. Then, too, he has to deal with a class of young men who, as a rule, come to the college but poorly prepared to take up the work and carry it on successfully. Indeed, it is extremely unfortunate that agricultural colleges are obliged to teach so much that is merely fundamental in its nature, much that might be far more economically obtained at home in the common and high schools; but, taking agricultural colleges as they are, some located in dairying sections, some in grain, and others in cotton growing States, some well-endowed and equipped, large, strong, independent institutions, others parts of universities, where they are more or less overshadowed and restricted in their influence, it is hard, nay, well-nigh impossible, to say what the professor of agriculture shall teach and have it apply to all cases. Representing, as I do, one of the oldest, largest, and best equipped of the agricultural colleges of the country, it is, perhaps, but natural that I should look at this question somewhat in the light of future possibilities, and, at all events, in the light of an all-around agricultural college.

What shall the professor of agriculture teach? My answer, in one word, is agriculture; in two words, practical agriculture, and never, under any circumstances, anything else. Specialties like dairying, cotton-growing, grain-raising, and the like will each take precedence naturally in the localities where they belong. But in a college like the one in Michigan no one line will at present take a long lead over another, but the whole ground has to be covered, so far as the agriculture of that region is concerned. Already the duties of the head of the department are those mainly of an executive officer, whose duty is to superintend and direct instruction rather than to teach; also to superintend the farm management and the agricultural experiments at the station. In the matter of teaching, we first separate the great subject of agriculture into its two natural divisions—vegetable economy and animal industry—and each of these subjects is taught by an assistant, who is a specialist. As the department grows, as it is certainly destined to do, subdivisions of the above will have to take place and other assistants will have to be employed, and thus the work done in the department will develop and improve in value as time goes on and more money becomes available for the work. The ideal instruction towards which we are all working, I believe, will be given only when there has been a perfect division of labor and each and every branch of agriculture is taught by experts.

I have said that the professor of agriculture should teach practical agriculture. I want to emphasize that. This is a practical age. Education is for the development of the mind. Agricultural education is for the development of the mind along agricultural lines. Our object is, or should be, to turn out practical farmers, not in any narrow sense, but men with all the advantages of trained minds and trained hands, to fill honorable places in life and withal to be prepared to compete successfully and creditably with others engaged in the same calling.

The college graduate ought, with these advantages, to get more out of life and above all out of his business than he otherwise would. If we fail to turn out such men, we fail in the prime object for which our agricultural colleges were established and for the maintenance of which many thousands of dollars are being spent annually. Science is all very well, but unless scientific truths can be taught and the practical application made clear so far as turning out practical agriculturists is concerned they would better not be taught at all. No professor of agriculture is a success until he makes these applications clear to his students. We expect also in our agricultural colleges that the professors of botany, chemistry, entomology, physics, veterinary science, etc., will teach their branches with an inclination toward agriculture rather than toward developing scientists.

The agricultural department must be the leading department in the college, otherwise it will suffer by comparison. The sooner this idea is appreciated and this policy adopted by those in authority everywhere, the better it will be for our agri-

cultural colleges and the clearer will the professor of agriculture see his way to success.

One of the first things to do in building a house is to clear away the rubbish. As the average student comes to us from the farm there is liable to be some rubbish in his mind that needs removing. Possibly he holds too roseate a view of farm life, a sort of "bed of roses" theory, such as public speakers sometimes deal out to farmers, or, what is more likely in these times, the possibilities and real advantages of farm life is not fully appreciated. The "calamity howler" has got in his work; may be it has been dinned into the boy's ears from the cradle up. These extreme ideas should be cleared away and in their place the agricultural situation should be presented as it is; its advantages, its opportunities, its difficulties candidly weighed. Then go ahead on that basis and build up enthusiasm and love for the work by teaching the boys how to apply intelligence to labor, and see that they do it.

It always seemed to me that the logical place to begin in the teaching of agriculture was with the soil itself and from that point build up. Practically, however, we are unable to do this, in Michigan at least, for the reason mainly that our students are not sufficiently well grounded in scientific knowledge to take up this work to best advantage in their freshman year. Therefore we give, as our first instruction in agriculture, breeds of live stock. We study their history and characteristics. We illustrate so far as possible with living specimens and it is the policy and practice of our college to keep a large variety of specimens on hand. Where this is not possible a visit to neighboring herds would suffice. We have a complete set of herd books of all the pure-bred horses, cattle, sheep, and swine, and each student is required to trace the pedigree of one or more animals in each and to write an essay upon some one breed. Passing to the sophomore year we give instruction in soils, fertilizers, drainage, crops, how to cultivate them, advantages of leguminous plants in developing nitrogen in the soil, etc. We familiarize them with and instruct them in the various implements of the farm. In the junior year we give instruction in the breeding and feeding of live stock and the relation of the stock to the crops of the farm. This is necessarily quite scientific and yet our attempt is also to make it thoroughly practical. In the senior year specialties in farming are taught. All instruction is given by lectures, copies of which, containing reference notes, are distributed among the members of the class, thus avoiding the necessity of their taking notes.

Everything is illustrated so far as possible by seeing the actual thing itself and often by using it, or, if it is a piece of work, by doing it. Thus we teach the student some knowledge, and what is of equal importance, "how to know." One thing is left and that is, "how to do."

This brings us to the matter of student labor, one of the most difficult problems with which the professor of agriculture has had to contend. How can it be utilized to advantage? There are innumerable obstacles in the way. Well, the first thing to do is to cut entirely loose from the old idea that there is dignity in labor because it is labor or that labor is of any use whatever, except as a means to an end. It is valuable for what it brings. Most good things that come to us come through hard work. Indeed, this is true of all that we prize most highly. Labor for an object, good hard work, doing one's level best, is edifying; it strengthens character; it builds up manhood. Work for the sake of work soon becomes drudgery, is discouraging, and tears down rather than builds up. This is just as true of a student as of any one else. Possibly we have forgotten this. Take the student, then, on the assumption that he is somebody, that he is more than an average being, which he is, and treat him accordingly. If he is given a hoe and told to go out with Patrick to dig potatoes or stumps, placed on a level with unskilled labor, at half pay at that, is it any wonder that the boy does not like it? Is it any wonder that he kicks? He would not be much of a fellow if he did not kick. Students under the old system are troublesome and mischievous simply because they hate the system. A better

policy, and one that I am happy to say is now in successful operation at the Michigan college, is to take the student to one side and say to him: "We have a certain piece of work to do and we want you to do it. It will require both mental and manual labor. We can lay the plans and set Patrick to carrying them out, but we are morally certain that he will spoil something when our backs are turned. Now, you are a student, interested in this work, possessed of both intelligence and ability, and we want you to lay out the plans under our counsel and do the work, and we will hold you responsible for its success or failure." Suppose, by way of illustration, that it is an experiment with potatoes to determine the comparative value of different depths of planting, we say to him further: "This is to be your experiment; you are to read up all the bulletins and other literature that you can find upon the subject, post yourself thoroughly, prepare the ground, plant the potatoes, cultivate them, destroy the weeds, and keep off the bugs, and when through dig and weigh all the potatoes. Make full notes of your work and the condition of the crop from the beginning to the end of the experiment, and record the results in a book, which we will furnish for the purpose. This will be filed in our office and will serve not only as a memento of your labors, but if your work has been well done it will add one more item to the constantly accumulating fund of agricultural knowledge." What have we got now, a shirk, a drone, or a troublesome fellow? No. He is now interested, eager, enthusiastic, and instead of being a source of annoyance to us he has become our helper, our coworker, our pride. Each man can be furnished work according to his ability. That which is purely educational and of no benefit to the department is not paid for-that which is of benefit to the department is paid for. But all labor is thus educational. Now the student has not only learned "how to know," but he has learned "how to do." He has learned how to do one piece of work that required both thought and action and he has learned to do it well. This lesson is now a part of himself. It will abide with him forever. The experiment station has done double duty this time. It was one of the reasons why the stations were located at the colleges, that this might be done; that the student might learn (presumably it was thought that this might be accomplished by observation) something of experimentation. In the light of experience we are inclined to think that our benefactors builded more wisely than they knew.

To summarize: The professor of agriculture should teach, through his department, practical agriculture, or, in other words, should lay special stress upon the practical application of scientific truths concerning agriculture. He should divest the student's mind, through precept and example, of all false notions concerning agriculture. He must replace these with correct ideas, and at the same time lead him to become interested and enthusiastic in the work. Just what he teaches will depend considerably on where he is located. How he teaches it is of far more consequence. His great object should be to turn out successful agriculturists, who will go back upon the farms and make success in practical life. From those thus sent forth will come ample numbers of young men thoroughly competent, with a few additional years of post-graduate work, to fill positions in our agricultural colleges and experiment stations as teachers and investigators.

What a grand and noble work this is, the lifting up of the agricultural masses through the medium of our young men. It is a worthy ambition to be a professor of agriculture. The influence he exerts can not be measured. He has many difficulties, many trials, many discouragements, but all these vanish like mist before the sunlight of the great good he can do when his duty is properly performed.

Methods of Irrigation.

By L. G. Carpenter, *of Colorado.*

Irrigation may be practiced for two quite distinct objects: in one the water is valuable as an element necessary in plant growth, in the other as a manure for the substances it holds in suspension or solution. In the one case water is needed in com-

paratively small quantities, for the absolute needs of the plant are small; the application is discontinuous for short periods of time; other things being equal, the shorter, the better.

As a manure, water as it is found in nature is very dilute and when applied for this purpose it needs to be applied in large quantities. In cases it has been known to be so much that if the year's waterings were applied at once the plant would be submerged to a depth of over 200 feet by the water absorbed, or over 1,400 feet by that applied. Irrigation with large quantities is applied to meadows; it may be carried on in winter when the water is above the freezing point, and may be continued for days at a time, when if applied in small quantities injury would result to the character of the herbage.

The two cases I have mentioned differ in more than the quantity of water applied; there seems to be a different interaction between the sod and the water and its contents.

The limits of the two types are fixed somewhat by climatic considerations. When plants need watering there is usually a scarcity of that element, and irrigation with large quantities, as here meant, is not possible. Hence, as a general rule, dry and hot countries use less water than cold and wet ones. In the former all or most crops need irrigation; in the latter only forage crops are watered.

In practice there are insensible gradations, with variations too numerous to classify, leading from one type to the other.

In the United States we have been reluctant to practice irrigation except when compelled by necessity; our irrigation type consists in the use of small quantities of water, though the quantities may sometimes be considerable. These exceptions are few and isolated.

This type of irrigation we may divide into three methods, which may be subdivided indefinitely according to the plan of distribution adopted.

Before irrigation of either type can be practiced water must be brought to the land, which is done where possible by canals. Pumping is too costly except for low lifts or for exceptionally profitable crops. The irrigation canal differs from the navigation canal in that it seeks the high levels, so as to command as much land as possible. It may vary in width from 1 to 100 feet and in length from a few rods to 100 miles and over. It may water a few acres or hundreds of thousands. The greater canals cost hundreds of thousands of dollars for construction, frequently requiring long tunnels, expensive flumes, and large reservoirs. The expense may be borne directly by those interested or first by a company. The first cost is usually from $5 to $15 per acre.

From these principal canals secondaries are again built, which may be themselves of considerable size. These are usually constructed by separate corporations composed of those directly interested. These may again be divided, until finally the water is brought to the bounds of the undivided farm. It is only then that the farmer can complete his own system of ditches. The method he will adopt will depend upon various circumstances, the character of the soil and crop, the subsoil, the slope, the amount of water available, the amount of capital. Where mixed cultivation is practical it is essential that the method be applied to different crops, so that the same arrangement of ditches may be used for a series of years.

All methods are designed to accomplish the same object, which is to apply the water uniformly to the whole surface of the field, however irregular or uneven it may be. If more water is applied in one place than in another, unevenness in ripening or growth takes place; if it stagnates, then killing may take place, or in meadows, aquatic plants will appear. The minor inequalities are frequently leveled, but as yet extensive gradings are rarely attempted here, as is common for permanent meadows in Italy and France.

As before mentioned, irrigation in the United States is of the type with a limited amount of water. We may recognize three methods: (1) By submersion, (2) by flooding, (3) by infiltration, better known as the row or furrow system.

These may be again indefinitely subdivided according to the arrangements required for special classes of circumstances.

(1) *Submersion.*—In this case the farm is divided into compartments or basins by dikes of earth, 1 or 2 feet high. These are filled with water, which is allowed to stand until enough has been absorbed by the soil. Its convenience is that after once the ground is prepared it requires no skill in irrigation. The first cost is greater than with other methods. It is not well adapted to ground of a slope more than 20 feet to a mile, though sometimes used to 40 or even 60 feet. It is almost the only method which may be used for lands of less than 20 feet slope to the mile, hence its practice is largely confined to level countries. In Egypt it is successful with a slope of 6 inches to the mile. It has been practiced in Kern County, Cal., quite extensively. It requires large quantities of water so as to fill the compartments quickly, hence it is likely to go out of use on a large scale. The method is also used by the Mexicans. This method is used where water contains a valuable sediment and gives use to the system of Colinatage, as in the sterile plains in southern France.

(2) *Flooding.*—This method is that almost universally followed for cereals and meadows, and is the most elastic of methods, and capable of being infinitely varied in plan to suit the local needs. It may be used equally well with small or large supplies of water and with slopes from 20 feet per mile to the steepest. In this method the attempt is to cover the ground with an even sheet of flowing water. Temporary ditches, usually plow furrow, are needed to assist in the distribution. More skill is needed in the irrigator than in the other methods. The water is turned out from the laterals by small dams or cuts in the backs, and then the skill of the irrigator is required to distribute the water uniformly. By small dikes or a few sods the water is deflected to the higher places first; the low ones will take care of themselves. One important thing is never to allow the water to stagnate. This method is the general favorite. In some soils, as adobe, which are inclined to bake on drying, it has to be applied with caution, and sometimes the next method is used.

(3) *Infiltration.*—This is generally known as row irrigation, but there are some varieties which may be included in infiltration methods, and yet are not properly row irrigation. This method is that applied primarily to hoed crops which are planted in rows or need hilling, as corn, potatoes, beans, etc. The method consists in running the water between the rows, and for a time sufficient for the water to soak through the intervening space. It might be used for very steep grades, but precautions may then be necessary to prevent washing, as also in the case of flooding. The danger of this may be lessened in both cases by the direction the water is allowed to run along the slope. It is wasteful to make the rows long, though in one case when the rows were one-half mile long irrigation was given with a depth of 4 inches, which, as irrigations go, is economical. The question is almost invariably asked, "How much water is needed?" It may briefly be said: That it requires both favorable circumstances and skillful irrigation to make a uniform irrigation with depth less than 3 inches. The quantity varies according to crop, soil, and subsoil. The amount applied in retentive soils by skillful irrigators in Colorado amounts with the rain during the irrigating season to from 27 to 32 inches. Experiments in New Mexico give about the same result, and considerable unpublished data from the southern end of the San Joaquin Valley, California, do not vary far from the same average.

Grass or forage crops will evidently take much more than grain crops.

In attempting to study our irrigation on any side one can not but be impressed with the little systematic knowledge we possess, and I can not forbear suggesting to our Western stations the importance of the problems connected with this practice which is the basis and the limit of the agriculture of the arid West. The whole field needs to be traversed; such experiments as those of Mangon, in France, thirty years ago, need to be repeated and extended. We need to know more of the methods, their limitations and capabilities, the amount of water needed, the sources of loss,

whether by plant-growth, transportation, evaporation from soil, or passage through subsoil. Our ultimate extent of agriculture in the extreme West depends on the economy we can make of water, and the ultimate economies will need to be pointed out by the experiment stations.

Another second remark I would like to make in regard to the East. There is a growing interest in the East, if one may judge from the correspondence that comes from there regarding the practice. I think the conclusion of every one who becomes acquainted with the practice in the West is that it would be profitable in the East wherever the conditions are favorable. Often the loss from drouth in a single year would more than pay all the expense of a system of irrigation, and there are few years when it would not increase the value of the products by several dollars per acre. The more I have become acquainted with irrigation the more have I become convinced of its desirability for the East, and the belief has become more settled, if possible, after studying this summer the irrigation of the valley of the Po, in northern Italy. This is too well known as the classic ground of irrigation in Europe to need description in that particular, and its fertility is proverbial. But coming from the West, where nothing grows without irrigation, and here seeing little difference between crops irrigated or not, the first question that struck me was, "Why do they irrigate?" The cereals are rarely irrigated, and all crops do well as a rule whether irrigated or not. The rainfall exceeds 30 inches, and is about the same as Michigan and central New York, and is as well distributed throughout the year. The important thing is, they do irrigate, and though they began it by degrees, six or eight centuries ago, they are so well satisfied with it that the area has doubled within the last thirty years, and they are willing to expend far larger sums in bringing water to the land than we in the West; as a rule, it is only the irrigated communities which are prosperous and which do not feel the presence of American and Indian competition.

The prosperity which comes with it is too well known to need remark. The influences of our experiment stations, which are interested in increasing the agricultural wealth and prosperity of the community, and improved methods, might find an additional line of usefulness in demonstrating by an object lesson at very small expense the applicability of irrigation to the East. The progress in the Eastern communities in this respect is apt to be slow, but, I think, it is known where the practice begun has been abandoned.

Forage Plants for the Semi-arid West.

By C. C. Georgeson, *of Kansas.*

By the semiarid West I mean in a general way the western half of Kansas and Nebraska and eastern Colorado. The boundaries are not sharply defined. There are years when the rainfall is sufficient to raise good crops of all kinds over the greater part of this area, and again on the other hand it frequently happens, as in 1860, 1874, 1881, 1887, and 1890, that the dry area is carried eastward almost to the Missouri River. This vast region, covering upwards of 100,000 square miles, presents some features which must always have an important bearing upon its agriculture. Thus the altitude increases steadily as we pass westward from the Missouri River. At Kansas City the elevation above sea level is only 763 feet; at Manhattan, 118 miles distant, it is 1,042 feet; at Ellis, 302 miles from the Missouri River, it is 2,135 feet; and at Monotony, a station but a few miles from the Colorado line, 3,741 feet. With rise in elevation there is a corresponding fall in the mean temperature. Spring is later by two or three weeks in the western part of Kansas than in the eastern part, and the fall frosts set in two or three weeks earlier. In like manner the rainfall decreases as we pass westward. At Leavenworth, Kans., the average annual rainfall is 38 inches; at Topeka, 68 miles from the Missouri River, it is 32 inches; at Salina, about 197 miles from the river, it is 29 inches; at Hays City it is 22 inches;

at Wa Keeney it is 19 inches; and at Fort Wallace, near the Colorado line, it is but 13 inches.

It will readily be seen that the agriculture of this region must differ in many essential points from the ordinary practice followed in the East. It is preëminently a stock country, and while it was settled only by nomadic stockmen who drove their herds in there for the summer season, the native buffalo grass answered all the demands for feed. But this condition no longer obtains. The once unbroken prairie is now dotted with improvements of permanent settlers, who must of necessity still make stock raising a prominent feature of their agriculture. In the valleys along the water courses, where irrigation is practicable, all farm crops succeed. But it is different on the uplands, where the settler must depend upon the meager rainfall. The small grains, wheat, rye, and in most seasons barley and oats do well there; but Indian corn, the great American forage crop, is a failure, or at least it fails so often that it is never safe to calculate on more than a crop of fodder. With them it is therefore a serious question what to grow in the line of forage plants. They must place their dependence on other crops than corn, but the question is, what shall it be? It is part of the duty of the Kansas Experiment Station to aid in solving this problem, and to this end we have experimented with a large number of forage plants. The station, however, is barely on the edge of this belt. It is located at 96° 40′ west longitude, and the annual rainfall is about 30 inches. Manifestly many things would succeed with us which would be failures farther west, although we fail to grow satisfactorily most of the grasses so highly esteemed in the East. We can raise fine crops of red clover, and orchard grass is the surest of the tame grasses. But corn is frequently only a partial success. All of these fail in the semi-arid West. The United States Grass Station at Garden City, located in about 101° west longitude, has done some excellent work in testing forage plants suitable to that region. And I am indebted to Prof. J. A. Sewall, superintendent of the Station, for a list of the plants which he has grown successfully. He writes as follows:

"From the results of experiments of 1892, I can confidently speak of the following as profitable and practical: *Bromus inermis* (most excellent every way), *Panicum virgatum*, *Agropyrum glaucum* and *A. tenerum*, *Avena elatior*, *Festuca elatior*.

"Of the forage plants, the following have proved very successful: *Anthyllis vulneraria*, *Galega officinalis*, Alfalfa (*Medicago sativa*), Sainfoin (*Onobrychis sativa*), Red Kaffir corn, Jerusalem corn."

All of these, with one or two exceptions, have also been grown successfully at the Agricultural Experiment Station.

The sorghums, both saccharine and nonsaccharine, are grown with a measure of success in the West. The Early Amber and a few other sugar-bearing varieties are often sown broadcast and cut and cured for hay. It is a reasonably sure crop on the uplands, and furnishes a good article of feed. Of the nonsaccharine sorghums, the leading sorts are Red Caffir corn, White Kaffir corn, Millo maize, Jerusalem Corn, and the so-called Egyptian Rice Corn, all of which are grown for the seed as well as for the fodder. We have tested upwards of one hundred and fifty varieties at the experiment station during the last three years, and the above named sorts take the lead. For the production of grain the Red Kaffir corn is the best of all. We have raised as much as 71 bushels seed per acre of this variety, and it matures early enough to escape injury from frost in ordinary seasons. The variety called Jerusalem corn was introduced only a few years ago, but has already gained favor with Western farmers. Prof. Sewall states that he has raised 30 bushels per acre with a rainfall of only 5.06 inches from sowing until harvest. The seed is not only good feed for cattle, but furnishes a fair article of human food.

Next to these, alfalfa is the most widely cultivated forage plant in the West. It grows to perfection on the lowlands, along streams, especially when irrigated, and it also does measurably well on the uplands, where it generally yields at least two cuttings, the second crop being frequently allowed to go to seed. While it can not

supply the place that clover occupies further east, it comes nearer to it than anything else so far brought into general culture. Many other forage plants have been tested, both at the United States Grass Station and at the Agricultural College Experiment Station, and among them are some of great promise. Of the grasses the one of greatest promise is *Bromus inermis*, a grass of comparatively recent introduction. It has done well at Manhattan during the last two years, and I concur with Prof. Sewall in pronouncing it "most excellent every way." It makes a close sod, and furnishes a thick growth of foliage of good quality, which is all that can be asked of any grass under those trying conditions. The other grasses mentioned by Prof. Sewall as eminently successful at Garden City have also been tried at Manhattan, where they did fairly well, but their growth has not been remarkable. And the same may be said of sainfoin, which Prof. Sewall recommends as excellent for sheep pasture at Garden City.

We have grown certain varieties of the Soy bean very successfully at Manhattan during the last three years, and it gives promise of becoming a very useful forage plant for the semi-arid region. It produces a highly nutritious feed, and it has the ability to withstand drought better than most farm crops. We grew this year a little over 6 acres of Soy beans, in four varieties. The season was dry and hot during July and August, yet they did not appear to suffer. A portion of each variety was made into ensilage, which is now being fed to the dairy cows. The silo was opened only the day before I left, and I am therefore unable to report results. The seed was distributed to many farmers over the State for trial the past season, and the following letter is a fair sample of the reports I received from the experimenters:

"WHITE CITY, KANS., *November 11, 1892.*

"DEAR SIR: Yours of the 29th at hand. In regard to the Soy beans received from you, would say that I planted them June 3. Owing to wet weather, the ground was plowed too wet, and consequently dried lumpy and hard. Jack rabbits ate about half of all the plants that came up. I raised, however, about a bushel and a half of beans from 2 pints of seed. They certainly are great drought-resisters. Dry weather don't seem to hurt them as it does other plants. I think them a boon to farmers in this western country, as a fodder and fertilizing crop.

"Yours truly,

JOHN HOLT."

I could produce many other similar reports, but this sample is sufficient. From the success thus far attained, I am encouraged to believe that the Soy bean is destined to play an important part in the agriculture of this semi-arid region.

The plants here mentioned comprise all that so far give promise to be of value for this region.

THE ESTABLISHMENT OF OFFICIAL METHODS OF EXPERIMENTATION.

By F. A. GULLEY, *of Arizona.*

In assigning this topic, I suppose it is the design of the committee to discuss the advisability of attempting the establishment of official methods of experimentation, something on the plan adopted by the Association of Official Chemists.

First, as to the possibility:

Official methods of chemical analysis are much easier to formulate than official methods of conducting the great variety of experiments undertaken by the stations.

The chemist deals with matter which may be separated, measured, placed under control, all that is added or eliminated known and estimated, and the final product definitely determined.

In an experiment which deals with animal or vegetable life we have a problem which includes many unknown quantities. We may keep a record of our opera-

tions, and we may measure what we supply in the way of nutriment, or perhaps it would be more accurate to say what we place in reach of the subject experimented with; but with all our skill we must confess that our actual knowledge of the subject at the start, of the effect of the treatment given, and of the final result, is so limited that our conclusion is pretty largely guesswork. As yet we can only judge superficially, owing to our lack of knowledge of principles. It would seem, therefore, that before we can attempt to formulate official methods of work, we must be prepared to do better work in many of the stations.

It was, perhaps, necessary in beginning, to do work, the result of which would satisfy the people in general that we were accomplishing something of value, work that had a practical application; but we are coming to the end of this class of investigations, and we have stumbled against a few rocks below the surface that must be grubbed out before we can go on.

It may be possible to adopt a uniform plan for conducting certain operations, but if the premises on which we base our work are uncertain or unknown, we can hardly hope for similarity in results.

Take for instance fertilizer and plant tests. Recent work in soil physics would seem to indicate that certain factors connected with the soil not yet understood may, under certain conditions, directly or indirectly influence plant growth to a greater extent than plant food as ordinarily supplied. Until we know something more of the mysteries of the soil, scientific manuring is a misnomer and results obtained misleading.

Our experiments have carried us but little farther than the general knowledge obtained by the practical farmer without our assistance, which may be expressed by saying that, generally speaking, land that is well fertilized and well cultivated will, as a rule, but not always, produce a good crop; and some soils and crops respond to certain kinds of fertilizers better than others, but not uniformly so.

In his report on Physical Properties of Soils to the Agricultural Department, of the present year, Prof. Whitney says the practical farmer can judge more correctly of the condition of the land and what it is best fitted to produce, from its general appearance, than the agricultural chemist can from a study of its chemical composition.

The agricultural chemists, or at least some of them, may not admit this to be the fact, but it may not be far from the truth.

The results we get from experiments in stock-feeding are as unsatisfactory as those in plant growing and fertilizer work.

We have obtained some general knowledge of the value of certain feedstuffs, but as in crop-growing the practical farmer is pretty close to us; while we have given him some valuable suggestions, and some of not much worth, when he questions us very closely we look wise and talk about compounding rations, nutritive values, and nutritive ratios, etc., something beyond his comprehension; and it is an open question if it is not somewhat hazy with us.

Books could be written on what we don't know of the influence of light, heat, and moisture, atmospheric influences on plant and animal growth; but enough in this line, except to say that this lack of knowledge of the principles that underlie our work seems to me the one great obstacle to the adoption of official methods.

I believe we all recognize the need, the absolute necessity in fact, for thorough and exhaustive study of those mysterious but active forces in soil, plant, and animal, not simply to enable us to work in the same way, but that we may work at all intelligently.

Where shall this work be done and who shall do it?

At one of the meetings of this Association, a large majority of the delegates present were utterly opposed to the establishment of a central station at Washington to be equipped for investigations of a higher order than could be provided for in the State stations, and I dare say the sentiment is as strongly against such a project

now as it was then. The work must be done, and several of the stations of the country are taking it up as far as their means will permit.

In looking over the Office of Experiment Stations Bulletin No. 12, I find the orangization lists show there are fifty-three stations in forty-six States and Territories, six States having more than one station. Three hundred and twelve expert investigators are named in the list of station workers. This number includes but nine directors, while fully half of the station directors give part of their time to investigation; and it does not embrace assistants. The list is classified as follows:

11 Chemists,	49 Horticulturists,	46 Agriculturists,
38 Botanists,	35 Entomologists,	24 Veterinarians,
14 Meteorologists,	4 Biologists,	4 Dairymen,
4 Physicists,	3 Mycologists,	3 Irrigation Engineers,
2 Geologists,	1 Microscopist,	1 Viticulturist.

Twenty-seven men work in two lines, mostly doubling up on botany, horticulture, and entomology.

Of the regular stations, all but Ohio find it necessary to employ a chemist, while on the other hand the State stations of Massachusetts and Connecticut, with the exception of a mycologist in each, show only chemists on their lists.

The general plan of organization and work in one-half or three-fourths of the stations is very much the same, and with some slight difference in details, practically the same line of experiments have been taken up.

The question I would submit is this: Can 111 chemists, 49 horticulturists, 46 agriculturists, 38 botanists, 35 entomologists, etc., working in 46 different States and requiring as many different laboratories and sets of apparatus, working largely on the same lines, accomplish as much of value as could one-third of the number in each specialty, supplied with three times the facilities in the way of apparatus and assistants that they now have?

Official methods must be based on a better knowledge of principles than we now possess, but the study of principles requires expert skill and materials for working with, that are beyond the means of a station equipped for several lines of work.

We have progressed so far that further investigation in most lines requires for expert skill and apparatus an outlay of from $4,000 to $10,000 per annum for one line of work; and I can conceive of no establishment of official methods until many of our stations devote almost their entire energies to one line of investigation.

If the experiment station is to be considered a training school for college students or model farm for the people of the community, it should have the regulation outfit of agriculturist, horticulturist, chemist, botanist, entomologist, dairyman, etc., and a farm, garden, laboratories for each line of work—in fact, the whole field of agriculture should be represented. The head of each department should have his proportion of the funds to secure harmony, and such an institution would undoubtedly be of value in most States, but shall we expect much original research when the working force is spread over so much ground?

It would seem that the boards of control of some stations and some college presidents have not made sufficient distinction between the object of the agricultural college and the object of the agricultural experiment station, nor do they always appreciate the importance of costly ability and expensive machinery in the work of investigation.

While we have an immense area of country and great diversity of climate, there is not such wide variation in adjoining States that it is necessary to make the same investigations in each.

Disclaiming any intention of questioning the good judgment of State officials, I am of the opinion that we may add greatly to the value of our results by division of labor and expenditure of the greater part of the man power and funds of one

station in one line of work. Having made this change in our policy, it will be possible, I believe, to gradually establish official methods of experimentation.

I do not feel competent to present a plan for such division of labor, but I may be pardoned for submitting a few suggestions.

I would suggest a conference of station directors of groups of States lying near together and having somewhat similar conditions and interests; such as the New England States, the Central Mississippi Valley States, the northern, and southern halves of the arid belt, the Gulf States, etc.

In each one of these several groups of States there may be found as many important subjects for investigation as there are States, and these single lines of investigation, to a considerable extent at least, could be apportioned by mutual agreement, and the assignment made should constitute the special work of the station, to which should be given one-half, three-fourths, or better still, the entire energies of the station.

We have an example of what may be accomplished in equipping a station for a single line of work in the sugar station in this city.

Except in verification field tests, there is no necessity for attempting to duplicate the work of this station by expending $1,000 or $2,000 a year in any other Southern State.

Suppose some other station should take up the cotton plant as this station has sugar cane, is it not probable that we should get more positive data in regard to this plant from the one station than we now get from the nine or ten stations that have dabbled in cotton more or less?

Suppose some one station should confine its work to animal nutrition, or that two or three stations should divide the work between them, would it not be possible to disperse the fog that confuses our work in feeding?

The question of soil physics is of great importance in every State, but in the arid belt it is most important of all questions and most needs investigation. If, however, it is to be made one of ten lines of investigation carried on at the same time at one station with no additional help, it might better be omitted entirely.

But enough has been said on this line. I believe all will agree that a much higher class of work could be attempted and more knowledge gained by the division of labor suggested than is accomplished at present.

With the work of the experiment stations of the United States classified and apportioned as outlined, I believe it would be possible for this Association to appoint standing committees composed of men qualified to examine and make official reports upon the work of the stations adopting a specialty. The investigation of the methods of work could be made exhaustive, and from this careful scrutiny it would in time be feasible to build up a system of official methods.

What is the Live Weight of an Animal?

By H. J. Patterson, *of Maryland.*

It is very evident to all who have had anything to do with the weighing of animals, or who have even given the matter thought in looking over the work of others, that there should be something more specific as to what should be considered the starting and ending weight of animals under experiment; how these weights should be obtained, and the manner, time, and condition in which animals should be weighed. The question of the great fluctuation in weight from day to day is worthy of considerable attention, and, if possible, steps should be taken to eliminate this source of error, or at least to greatly reduce it. In looking over the records of weights of animals under experiments and comparing the methods by which these weights have been obtained, we find that it is indeed a very confounding mass of figures, a set of figures which has mainly the effect of producing doubt and distrust. We find recorded in our station literature almost every conceivable method of obtain-

ing the weights of animals, having on the one extreme the holding of pigs at arm's length by their hind legs and guessing at the loss or gain, and at the other the weighing on delicate balances down to 1 gram. We also find that scarcely two persons will follow the same methods and details. It is often the case that the same person will not follow the same methods and details in two different experiments. Still worse, we sometimes find that there was no uniform method used as to manner, time, or condition of weighing the same animals throughout the same experiment.

It is only when we consider the fact of these great discrepancies and lack of uniformity, together with the fact that the conclusions of experiments are often based wholly upon the live weight, that the full importance of this subject becomes apparent.

The natural and normal state of animals is to have food and water always at hand and to partake of these whenever there is the slightest craving or inclination. In such surroundings, and other things being equal and normal, we should expect that the fluctuations in weight due to the change in the amount of material contained in the stomach should be reduced to a minimum. Unfortunately up to this time I have been unable to find any consecutive weighings of animals subjected to these normal conditions to test this point.

In the practice of feeding animals with the modern principles and advanced domestication many unnatural conditions have come into vogue, which makes it very important to us in our experiments to have some definite manner and condition for weighing, and to obviate, if possible, the extremes of fluctuation in weights due to the greater or less retention of food and water in the body.

The first question before us in this connection is: *Shall we weigh before or after feeding and watering?*

Reasoning on the basis that an animal's normal condition is to have all its wants satisfied, we should most naturally say that they should be weighed after feeding and watering. We also find that it is the common practice in stockyards to buy and sell cattle after they have had free access to hay and water. This custom has most probably grown out of the desire to eliminate sources of uncertainty and probable fraud.

To determine if the data at hand would throw any light upon this question I have collected and discussed the results of nearly 5,000 (4,988) weighings before and after watering. These figures have been procured from experiments with 34 different animals, varying from 15 to 175 consecutive weighings each. These represent all the figures I have had access to, which were at all comparable. Although many more like records exist it is believed that these are sufficient to answer our purpose.

The summary and averages of these weighings are given in the following table:

TABLE I.—*Average of weighings.*

Source of weights.	Date of beginning of experiment.	Animal.	Average weights.		Average amount of water drunk.	Number of weeks in experiment.	Fluctuation greatest before watering.	Fluctuation greatest after watering.	Average fluctuation.		Range of fluctuation.	
			Before watering.	After watering.					Before watering.	After watering.	Before watering.	After watering.
			Lbs.	*Lbs.*	*Lbs.*		*Wks.*	*Wks.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Md	Jan., '89	Cow Ramette	1,047	1,120	73	9	5	4	49	46	12—81	24—72
Md	Jan., '89	Cow Rose	767	814	47	9	3	6	31	34	18—70	13—78
Md	Jan., '91	Steer A	942	971	29	3	2	1	31	24	18—46	10—46
Md	Jan., '91	Steer B	956	985	29	4	3	1	28	30	18—38	16—42
Md	Jan., '91	Steer C	568	583	15	3	2	1	18	13	13—27	9—19
Md	Jan., '91	Steer D	571	590	19	4	1	3	21	20	17—25	12—25
Md	Feb., '92	Steer 1	730	744	14	3	0	3	22	35	14—28	31—41
Md	Feb., '92	Steer 2	741	768	27	3	1	2	23	35	21—24	23—57
N. Y	Jan., '84	Cow Jem	700	739	39	9	3	6	26	31	6—37	15—45

TABLE I.—*Average of weighings*—Continued.

Source of weights.	Date of beginning of experiment.	Animal.	Average weights.		Average amount of water drunk.	Number of weeks in experiment.	Fluctuation greatest before watering.	Fluctuation greatest after watering.	Average fluctuation.		Range of fluctuation.	
			Before watering.	After watering.					Before watering.	After watering.	Before watering.	After watering.
			Lbs.	*Lbs.*	*Lbs.*		*Wks.*	*Wks.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
N. Y	Jan., '84	Cow Meg	761	794	33	9	4	5	34	31	15—59	17— 46
N. Y	Dec., '84	Cow Ceres	740	806	66	23	4	19	32	45	10—65	13— 86
N. Y	Dec., '84	Cow Juno	903	954	51	23	8	15	40	47	7—79	10— 83
N. Y	Dec., '87	Cow Jem	902	965	63	8	2	6	34	39	15—75	18— 69
N. Y	Dec., '87	Cow Meg	882	950	68	8	1	7	18	30	7—26	15— 53
Pa	Dec., '85	Steer 1	1,083	1,115	32	14	4	10	26	32	10—50	10— 67
Pa	Dec., '85	Steer 2	1,051	1,079	28	14	3	11	21	24	8—40	10— 52
Pa	Dec., '85	Steer 3	1,151	1,192	41	14	3	11	26	29	12—40	10— 50
Pa	Dec., '85	Steer 4	1,125	1,176	51	14	6	8	19	18	5—40	5— 50
Pa	Dec., '85	Steer 5	808	846	38	17	6	11	31	35	15—65	10— 55
Pa	Dec., '85	Steer 6	699	728	29	15	7	8	25	26	5—40	13— 40
Pa	Dec., '85	Steer 7	705	748	43	16	6	10	27	29	10—50	10— 60
Pa	Dec., '85	Steer 8	643	677	34	17	7	10	29	29	15—60	15— 50
Pa*	Nov., '86	Steer X	1,083	1,103	20	2	1	1	11	11	0—27	0— 38
Pa*	Nov., '86	Steer 1	1,162	1,201	39	15	.....	.....	9.8	9.6	0—40	0— 40
Pa*	Nov., '86	Steer 2	1,156	1,205	49	15	.....	.....	7	7	0—30	0— 35
Pa*	Nov., '86	Steer 3	1,216	1,261	45	15	.....	.....	12	13	0—50	0— 57
Pa*	Nov., '86	Steer 4	1,174	1,211	37	13	.....	.....	7.7	9.2	0—37	0— 50
Pa	Nov., '87	Steer 1	899	930	31	5	3	2	15	13	5—25	6— 21
Pa	Nov., '87	Steer 2	976	1,011	35	5	2	3	21	26	12—35	13— 45
Pa	May, '88	Cow Topsy	751	835	84	6	4	2	38	36	7—60	4— 50
Pa	Feb., '89	Steer 1	944	966	22	6	3	3	31	33	18—50	25— 43
Pa	Feb., '89	Steer 2	933	948	15	6	3	3	38	39	20—50	15— 65
Pa	Apr., '90	Cow Polly	658	714	56	13	7	6	39	37	5—90	15— 72
Pa	Apr., '90	Cow Flossie	605	662	57	23	11	12	35	37	7—85	5—190

NOTE.—The averages are made by taking the average of the weekly average, except in the cases marked (*), which are for the daily weighings.

From this table it appears: (1) That with 70 per cent of the animals the average fluctuation was greatest in the weights obtained after watering; (2) that with weekly weighings the range of fluctuation was greatest in the weights obtained after watering, with 60 per cent of the animals; (3) that the range of fluctuation in one week's weighings was from 0 to 190 pounds after watering and only from 0 to 90 pounds before watering; (4) that with the greatest care and following the methods least liable to error and having the minimum of fluctuation, we may have an error amounting to 10 or 15 per cent of the total weight of the animal used in experiments.

Let us next look at another phase of the question and see how the gains in weight, as obtained by weighing before and after watering, compare. For this purpose I have used the figures obtained with fourteen different animals under fattening experiments. The results are set forth in Table II.

TABLE II.—*Gains in fattening experiments as indicated by taking weights before and after watering, and using the averages of seven consecutive weighings at the beginning and ending of the experiments.*

Animals.	Number of weeks in experiment.	Gain before watering.	Gain after watering.	Difference.
		Pounds.	*Pounds.*	*Pounds.*
Ramette	9	95	97	2
Rose	9	117	118	1
Steer 1 (1885)	14	126	134	8
Steer 2 (1885)	14	156	162	6
Steer 3 (1885)	14	120	140	20
Steer 4 (1885)	14	116	104	—12
Steer 5 (1885)	17	165	200	35
Steer 6 (1885)	15	130	150	20
Steer 7 (1885)	16	143	161	18
Steer 8 (1885)	17	155	170	15
Steer 1 (1886)	15	128	143	15
Steer 2 (1886)	15	153	153	0
Steer 3 (1886)	15	145	155	10
Steer 4 (1886)	13	138	131	—7

From this table it will be seen that in all but three cases the gains indicated by the weights taken after watering are greater than those obtained before watering and that in the extreme cases 17 per cent of the gain would appear to have been due to food and water. This gives particular stress to the importance of always weighing in the same conditions; and gains to be compared with each other should be obtained in the same manner.

What shall be considered the beginning and ending weight and how shall it be obtained?—It is already pretty well agreed that we should use the average of several consecutive weights for the beginning and ending weights of an experiment; yet we often note that there has been but a single weight taken at the beginning and ending of an experiment, and that they are used to represent the loss or gain due to the particular treatment. A glance at the great fluctuations as recorded in Table I is sufficient to tell that this is unreliable, and that we must use more than one weighing to obviate and reduce this source of error. There is a danger in the other extreme and there must be a limit; consequently how many weighings shall we make and use in our averages?

In Table III are recorded the average weights obtained by using three, five, and seven consecutive weighings with steers on maintenance and fattening rations; also the gains as indicated by following these different methods. From these results we find, as we would naturally expect, that with the maintenance ration it makes but little difference in the different averages whether we use three, five, or seven consecutive weighings, and that probably the more we use the more nearly we approximate the truth. With the fattening rations we find less difference in the different averages than we should expect—in fact, in most cases the agreement is surprising. On this basis alone we would not be warranted in advocating more than three consecutive weighings each at the beginning and ending of an experiment. Cattle on fattening rations and doing well should gain 2 or 3 pounds per day, from which we see that if we use the average of seven weights instead of three that we may introduce an error of from 10 to 20 pounds, and consequently record a gain which was really that much less than was truly the case. The results in a few instances as recorded in Table III indicate that this source of error has been introduced. From the fact as presented by Table III, and reasoning on the above basis, I doubt if we would be warranted in using more than three consecutive weighings for our averages to represent weights in fattening experiments.

TABLE III.

STEER 1.

	Before watering.				After watering.			
	First weight.	Average of three weights.	Average of five weights.	Average of seven weights.	First weight.	Average of three weights.	Average of five weights.	Average of seven weights.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Maintenance ration:								
Beginning	870	880	884	886	905	918	919	920
End of two weeks	897	892	898	901	930	930	929	933
Indicated gain	27	12	14	15	25	12	10	13
End of experiment	900	902	903	902	920	929	930	931
Total gain	30	22	19	16	15	11	11	11
Fattening ration:								
Beginning	1,130	1,116	1,112	1,116	1,145	1,136	1,141	1,148
First month	1,150	1,152	1,143	1,144	1,170	1,171	1,170	1,173
Gain	20	36	31	28	25	35	29	25
Second month	1,185	1,179	1,177	1,181	1,227	1,223	1,212	1,213
Gain	55	63	65	65	82	87	71	65
Third month	1,210	1,210	1,207	1,204	1,270	1,262	1,257	1,255
Gain	80	94	95	88	125	126	116	107
Fourth month	1,245	1,239	1,245	1,244	1,295	1,287	1,290	1,291
Gain	115	123	133	128	150	151	149	143

STEER 2.

	Before watering.				After watering.			
	First weight.	Average of three weights.	Average of five weights.	Average of seven weights.	First weight.	Average of three weights.	Average of five weights.	Average of seven weights.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Maintenance ration:								
Beginning	953	959	965	969	971	993	998	1,002
End of two weeks	980	978	980	984	1,005	1,011	1,012	1,014
Indicated gain	27	19	15	15	34	18	14	12
End of experiment	958	963	967	969	986	995	997	1,000
Total gain	5	4	2	0	15	2	—1	—2
Fattening ration:								
Beginning	1,087	1,102	1,103	1,105	1,145	1,141	1,145	1,148
First month	1,120	1,119	1,120	1,113	1,150	1,147	1,148	1,142
Gain	33	17	17	8	5	6	3	—6
Second month	1,187	1,170	1,171	1,170	1,225	1,215	1,208	1,207
Gain	100	68	68	65	80	74	63	59
Third month	1,245	1,238	1,235	1,231	1,290	1,290	1,289	1,278
Gain	158	136	132	126	145	149	135	130
Fourth month	1,255	1,253	1,256	1,258	1,300	1,297	1,298	1,301
Gain	168	151	153	153	155	156	153	153

TABLE III—Continued.

STEER 3.

	Before watering.				After watering.			
	First weight.	Average of three weights.	Average of five weights.	Average of seven weights.	First weight.	Average of three weights.	Average of five weights.	Average of seven weights.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds*	*Pounds*	*Pounds.*
Fattening ration:								
Beginning	1,160	1,167	1,166	1,169	1,220	1,209	1,212	1,214
First month	1,205	1,202	1,194	1,191	1,225	1,232	1,225	1,228
Gain	45	35	28	22	5	23	13	14
Second month	1,234	1,213	1,222	1,219	1,285	1,272	1,262	1,258
Gain	74	46	56	50	65	63	50	44
Third month	1,300	1,292	1,291	1,291	1,300	1,328	1,334	1,336
Gain	140	125	125	122	80	119	122	122
Fourth month	1,315	1,312	1,314	1,314	1,372	1,365	1,367	1,369
Gain	155	145	148	145	152	156	155	155

STEER 4.

	Before watering.				After watering.			
	First weight.	Average of three weights.	Average of five weights.	Average of seven weights.	First weight.	Average of three weights.	Average of five weights.	Average of seven weights.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Fattening ration:								
Beginning	1,105	1,107	1,110	1,115	1,140	1,143	1,148	1,155
First month	1,132	1,139	1,142	1,134	1,167	1,167	1,170	1,169
Gain	27	32	32	19	27	24	22	14
Second month	1,195	1,192	1,192	1,186	1,235	1,227	1,228	1,225
Gain	90	85	82	71	95	84	80	70
Third month	1,250	1,248	1,246	1,240	1,300	1,296	1,293	1,289
Gain	145	141	136	125	160	153	145	134
Fourth month	1,240	1,240	1,247	1,253	1,260	1,271	1,276	1,286
Gain	135	133	137	138	120	128	128	131

The question may come up in this connection as to whether there is any relation between the amounts of material consumed, matter voided, and the loss or gain in weight. In order to answer this question, Table IV has been added. But a glance at it is sufficient to show that there is no *direct* relation, for where the difference between food consumed and matter voided would indicate a gain of 34 pounds, we find one of only 4 pounds; and again where we have an indicated gain of 14 pounds, we find a loss in weight of 11 pounds, and so on throughout the list.

TABLE IV.—*Relation between food and water, excreta, and gain or loss in weight.*

Steer 1.						Steer 2.					
Fodder eaten.	Water drunk.	Total eaten.	Total voided.	Difference.	Loss or gain in weight.	Fodder eaten.	Water drunk.	Total eaten.	Total voided.	Difference.	Loss or gain in weight.
Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
11.7	32	43.7	33.4	+10.3	— 7	12.3	41	53.3	33.5	+19.8	— 7
11.0	10	21.0	23.1	— 2.1	—16	10.5	23	33.5	30.5	+ 3.0	— 5
11.3	36	47.3	28.0	+19.3	+ 6	9.7	35	44.7	31.7	+13.0	+ 3
11.7	44	55.7	21.4	+34.3	+ 4	10.0	38	48.0	28.6	+19.4	+ 2
11.0	33	44.0	29.4	+14.6	+ 3	13.5	25	38.5	24.7	+13.8	—10
11.5	30	41.5	29.5	+12.0	0	11.3	43	54.3	29.0	+25.3	+13
10.9	32	42.9	26.3	+16.6	+ 3	10.4	32	42.4	32.9	+ 9.5	+ 2
11.5	33	44.5	28.5	+16.0	0	11.0	20	31.0	25.7	+ 5.3	—20
11.5	33	44.5	32.9	+11.6	0	11.6	48	59.6	32.8	+26.8	+23
11.3	28	39.3	30.2	+ 9.1	— 5	11.7	28	39.7	25.6	+14.1	—11
12.1	33	45.1	29.3	+15.8	+ 2	11.3	18	29.3	27.7	+ 1.6	— 7
11.3	33	44.3	26.1	+18.2	+ 2	11.0	45	56.0	27.0	+29.0	+ 7
11.9	33	44.9	28.0	+16.9	0	11.3	28	39.3	24.9	+14.4	— 2
12.0	28	40.0	33.4	+ 6.6	— 2	11.2	30	41.2	31.4	+ 9.8	0
11.6	35	46.6	30.8	+15.8	0	10.9	35	45.9	26.1	+19.8	0
12.2	35	47.2	21.4	+15.8	0	10.8	40	50.8	29.2	+21.6	+ 2
11.6	30	41.6	31.1	+10.5	+ 5	10.6	29	39.6	25.6	+14.0	— 2
12.1	30	42.1	25.1	+ 7.0	0	10.7	25	35.7	27.6	+ 8.1	— 5
10.3	25	35.3	25.6	+ 9.7	— 3	11.0	30	41.0	30.1	+10.9	— 5
11.4	33	44.4	29.4	+15.0	+ 3	10.5	35	45.5	28.9	+16.6	0

SUMMARY.

From the figures and results which have already been presented the following conclusions may be warranted:

(1.) That it would seem best to follow the rule of weighing before watering rather than after.

(2.) That the average of three weighings at the beginning and the same at ending an experiment should be used as the starting and ending weights.

(3.) We should always weigh in the same manner and condition.

(4.) That it is evident we should endeavor to find methods by which to obviate the great fluctuations in weight which usually occur from day to day.

PHYSICAL TESTS OF SOILS.

By R. H. LOUGHRIDGE, *of California.*

The subject of soil investigation or inquiry into its chemical and physical nature has recently begun to assume some prominence among those scientists who give their time to the study of those conditions that promote or hinder the growth and development of plants and animals.

A few of these have, however, for many years believed the subject to be of prime importance and worthy of serious attention, as preliminary to investigations in which the relation of fertilizers to crops is concerned.

Among these, Dr. Robert Peter, of Kentucky, and Prof. E. W. Hilgard, formerly of Mississippi but now of California, are pioneers in this country; for they began the analyses and interpretation of results as long ago as the fifties.

As more than one thousand analyses of soils from some fifteen States have been made by them or under their supervision, and under conditions and methods so uniform as to make the results entirely comparable, I wish briefly to present these methods both chemical and physical, in order that by their adoption by the experiment stations, the comparability may be extended to all soils over the United States. That such a result is desirable in the extreme no one can deny; and its practical value has recently been very forcibly demonstrated in the comparison made by Prof. Hilgard of soils of the moist and arid regions of the Atlantic and Pacific slopes of the United States in his report to the Weather Bureau, entitled "Relations of soils to climate."

The method of actual analysis is perhaps in itself of no very special importance provided accurate results are obtained; for the results from a given solution should be the same by any method.

It is the method by which the soil solution is obtained that we wish to lay particular stress upon; the condition in which the analytical portion is taken; the solvent used and the time of digestion; for it is these that make the method presented by Prof. Kedzie the object of criticism.

Uniform methods in the preliminary treatment of the soil is then the main point to be insisted upon by those having at heart the comparability of results and the utilization and preservation of the immense amount of work already done.

In this preliminary work there are two points which mainly produce the great differences between the results by the one method and that by Kedzie.

The first is in the size of the meshes through which the soil is passed; or the limit in size of the particles which make up the so-called fine earth. The method of the Kedzie chemists places the maximum at 1 millimeter, while that of our method is one-half millimeter.

This admission of grains of from one-half to 1 millimeter into the calculation would produce in some soils a great difference in percentage results. In many of our sandy soils several per cent of such coarse materials would be added to the basis of calculation, and to that extent dilute the fine soil with inert matter. This question as to what should be rejected from the analyses was considered very early in the history of soil investigation, and both Drs. Peter and Hilgard concluded that all above one-half millimeter should be relegated to the rejected grit and gravel series, as comprising matters entirely devoid of plant food.

The percentages are determined, of course, but it is useless to clog the filter with this increased amount of insoluble residue and dilute the already small amount of plant food.

To include gravel and such coarse material in a chemical analysis is of course preposterous and a limit must be made to the size of the particles admitted to the fine earth So long, then, as this limit is to be an arbitrary one, is it not by far the wisest course to adopt that of the one-half millimeter by which so much work has already been done than to take the one millimeter and throw out of comparison that work as well as the interpretation of results so carefully made by Prof. Hilgard on that basis. The hygroscopic moisture absorbed by a soil is a very important index to its power of resisting drouth, and hence is always determined under conditions representing the two extremes of extra dryness and of air saturated with moisture at a regular temperature.

We thus have data for comparison under uniform conditions; while on the other hand the Kedzie method takes an air-dried soil for its hygroscopic moisture determination, and the condition of atmosphere is not noted.

I have thus briefly sketched the points in the Kedzie method of analyses that are fatal to any attempt at comparison of results with the vast amount of work already done; and they are points embraced almost exclusively in the preliminary treatment of the soil. I will now present the method as used by us, and which has been prepared by Prof. Hilgard, and I sincerely hope that it will be adopted by those chemists who may take up the subject of soil analysis.

MECHANICAL ANALYSIS.

It is hardly necessary to review for you the troubles and trials that Prof. Hilgard was subjected to in his first investigation of the mechanical constituents of soil, and which led up finally to his designing the present apparatus, which he terms a soil elutriator.

I will only say that the cause of all his trouble in the use of the Nobel apparatus and with beakers was the strong tendency of the fine particles to coalescence, a ten-

dency that belongs to all from clay up to particles of 2 millimeters diameter or 16 millimeters hydraulic value. Prof. Hilgard therefore put into exercise his ingenuity and designed the present form of apparatus, though only recently has it been perfected as presented to you. A prime requisite is a uniformity in the velocity of each current of water.

To secure a uniform velocity it was of course necessary that the pressure of the column of water above the elutriator should be constant at whatever the height of water in the reservoir.

The Mariottes bottle fulfills these conditions, and is placed on a shelf some 15 or 20 inches above the top of the cylinder of the elutriator.

With this instrument very accurate results are obtained; and, what is more, sediment of any desired hydraulic value can be isolated by regulating the flow of the current.

The apparatus has the advantage over other methods, also, in permitting the operator to do other work, having only to keep an eye occasionally on it and an ear open to catch any irregular movement in churn or bubbles of air in the Mariottes bottle.

Method of Soil Analysis.

[Adopted by Drs. Robert Peter and E. W. Hilgard in the analysis of over 1,000 soils of the Southern and Pacific States, for the Tenth United States Census, and for the various State reports by the same authors.]

The soil is thoroughly broken up dry with a rubber pestle, or, in case of clayey soils, digested with distilled water until thoroughly disintegrated. It is then sifted or washed (as the case may be) through a sieve of 5 millimeters clear aperture; if washed, the muddy water must be evaporated to dryness with the soil slush and the whole thoroughly mixed. The samples so obtained constitute the "fine earth" to be used in chemical analysis; the coarse portions are to be further segregated by sieves and their mineralogical constituents identified with the microscope, reagents, or Thoulets solution, as the case may require. The fine earth is exposed to an atmosphere saturated with moisture for about twelve hours at the ordinary temperature (60°F.) of the cellar in which the box should be kept. For this it is sifted in a layer of about 1 millimeter thickness upon glazed paper, on a wooden table in a small covered box (12 by 9 by 8 inches) in which there is about an inch of water; the interior sides and cover of the box should be lined with blotting paper, which is kept saturated with water, to insure the saturation of the air.

After eight to twelve hours the earth is transferred as quickly as possible, in the cellar, to a weighed drying tube, and weighed; it is then placed in a paraffin bath; the temperature gradually raised to 200° (C.) and kept there twenty to thirty minutes (rapidity of raising temperature depending upon the amount of moisture in the soil), a current of dry air passing continually through the tube. It is then weighed again and the loss in weight gives the hygroscopic moisture in saturated air.

From the drying tube two quantities are weighed out; 2 to 2.5 grams for general analysis, and 3 to 3.5 grams for phosphoric acid determination. Of very sandy soils, as much as 4 grams may be taken for general analysis.

I.—General Analysis.

(1) The weighed quantity, usually of 2 to 2.5 grams, is brought into a small porcelain beaker covered with a watch glass, treated with 8 to 10 times its bulk of hydrochloric acid of 1.115 specific gravity and two or three drops of nitric acid, and digested for five days over the laboratory steam bath. At the end of this time it is evaporated to dryness, first on the water bath and then on the sand bath. By this treatment all the silica is rendered insoluble.

It is now moistened with strong hydrochloric acid and two or three drops of nitric acid, warmed, and, after allowing it to stand a few hours on the water bath, treated

with distilled water; then it is filtered from the insoluble residue which is strongly ignited and weighed.

Note 1.—If the filtrate should be turbid the insoluble residue which has gone through the filter can be recovered in the iron-and-alumina determination.

The insoluble residue is next boiled for fifteen or twenty minutes in a concentrated solution of carbonate of soda, to which a few drops of caustic lye should then be added to prevent reprecipitation of the dissolved silica. The solution is then filtered hot.

The difference between the weight of the total residue and that of undissolved sand and mineral powder is recorded as "soluble silica," being the aggregate of that set free by the acid treatment, and that previously existing in the soil. The latter, however, rarely exceeds 5 per cent.

(2) The acid filtrate from the total insoluble residue is evaporated to a convenient bulk. In case the filtrate should indicate by its color, etc., the presence of any considerable amount of organic matter, it should be oxidized by aqua regia, otherwise there will be difficulty in separating alumina.

(3) The filtrate thus prepared is now brought to boiling and treated with ammonia, whereby the iron and alumina are precipitated; it is kept boiling until the excess of ammonia is driven off, and then filtered hot. (Filtrate A.)

Note 2.—If the boiling is continued too long, filtration becomes very difficult and a part of the precipitate may redissolve in washing. Filtration may be begun so soon as the nose fails to note the presence of free ammonia; test paper is too delicate. Failure to boil long enough involves the contamination of the iron-alumina precipitate with lime and manganese.

(4) The precipitation of iron and alumina is well washed with boiling water, then removed from the filter to a platinum dish. The small quantity which unavoidably remains on the filter is dissolved with hydrochloric acid (boiling); the filter is then added to the alumina or may serve for filtering the alumina subsequently.

The iron and alumina precipitate (with filter) of No. 3 is dissolved in a mixture of about 5 cubic centimeters hydrochloric acid and 20 cubic centimeters water. Then filter (see note 1) and make up to 150 cubic centimeters. Take 50 cubic centimeters for the determination of iron and alumina together (by precipitation with ammonia) and 50 cubic centimeters for iron alone; keep 50 cubic centimeters in reserve. Determine the iron by means of a standard solution of permanganate of potash, after reduction; this latter is done by evaporating the 50 cubic centimeters almost to dryness with strong sulphuric acid, adding water and transferring the solution to a flask, and then reducing by means of pure metallic zinc in the usual way. The alumina is then determined by difference.

(5) The filtrate A from iron and alumina is acidified slightly with HCl. and if too bulky, is evaporated down to about 25 cubic centimeters (unless the soil is a calcareous one) and the lime is precipitated from it by neutralizing with ammonia and adding ammonic oxalate.

The precipitation of the lime should be done while boiling, as the precipitate settles much more easily. It is allowed to stand for twelve hours, then filtered off, washed with cold water and dried. (Filtrate C.)

By ignition the precipitate is partially converted into the oxide. This is then heated with twice its bulk of powdered ammonium carbonate, moistened with hot water and exposed to a gentle heat (50 to 80° C.) until all the ammonia is expelled. It is then dried below red heat and weighed as lime carbonate. When the amount of lime is at all considerable, the treatment with ammonic carbonate must be repeated till a constant weight is obtained.

(6) The filtrate C from the lime is brought into a hard Bohemian flask, evaporated down over the sand bath and the ammoniacal salts destroyed with aqua regia (Lawrence Smith's method.) From the flask it is removed to a small beaker and evaporated to dryness. This process usually occupies four to five hours. The residue

should be crystalline-granular; if white-opaque, ammonic nitrate remains and must be destroyed by HCl.

The dry residue is now moistened with nitric acid and the silica present is separated by filtration from the filtrate which should not amount to more than 10 or 15 cubic centimeters. Sulphuric acid is then precipitated by treatment with a few drops of baric nitrate; both the solution and the reagent being heated to boiling. If the quantity of sulphuric acid is large, it may be filtered off after the lapse of four or five hours. (Filtrate D.) If very small let it stand twelve hours. The precipitate is washed out with boiling water, dried, ignited and weighed. (Filtrate D.)

Note 3.—Care should be taken in adding the barium nitrate to use only the least possible excess, because in such a small concentrated acid solution the excess of barium nitrate may crystallize, and will not readily dissolve in hot water. Care must also be taken not to leave in the beaker the large heavy crystals of baric sulphate, of which a few sometimes constitute the entire precipitate, rarely exceeding a few milligrams. Should the ignited precipitate show an alkaline reaction on moistening with water, it must be treated with a drop of HCl refiltered and reweighed.

(7) Filtrate D is now evaporated to dryness in a platinum dish; the residue is treated with twice its bulk of crystallized oxalic acid, moistened with water and exposed to gentle heat. It is then strongly ignited to change the oxalates to carbonates; this treatment with oxalic acid must be made in a vessel which can be kept well covered, otherwise there is danger of loss through spattering. As little water as possible should be used, as otherwise loss is difficult to avoid from evolution of carbonic gas. Spatters on the cover should not be washed back into the basin until after the excess of oxalic acid has been volatilized. The ignited mass should have a slightly blackish tinge, to prove the conversion of the nitrates into carbonates. White portions may be locally re-treated with oxalic acid. The ignited mass is treated with a small amount of water which dissolves the alkaline carbonates and leaves the carbonates of magnesia, proto-sesquioxide of manganese, and the excess of barium carbonate behind. The alkalies are separated by filtration into a small platinum dish (Filtrate E), and the residue well but economically washed with water on a small filter. When the filtrate exceeds 10 cubic centimeters, it will on evaporation show so much turpidity from dissolved earthy carbonates as to render refiltration on a minute filter necessary, since otherwise the soda percentage will be found too large, magnesia too small.

Note 4.—If on dissolving the ignited mass the solution should appear greenish, from the formation of alkaline manganates, add a few drops of alcohol to reduce the manganese to insoluble dioxide.

The residue of barium, magnesium, and manganese compounds is now treated on the filter with hydrochloric acid, and the platinum dish is washed with warm nitric acid (not hydrochloric, for the platinum dish may be attacked by chlorine from the manganese dioxide), dissolving any small traces of precipitate that may have been left behind.

(3) The solution containing the chlorides of magnesium and manganese is now freed from the barium salts by hot precipitation with sulphuric acid, and the barium sulphate, after settling a few hours is filtered off. The filtrate is neutralized with ammonia, any resulting small precipitate (of iron) is filtered off, and the manganese precipitated with ammonic sulphide. Let stand twelve hours, and filter (filtrate F); wash with cold water, dry, ignite, and weigh as manganic proto-sesquioxide $Mn_3 O_4$.

(9) The filtrate F from the manganese is now freed from sulphur by acidulating with hydrochloric acid, evaporating down if necessary, and filtering. From the filtrate the magnesia is precipitated by adding an equal amount of ammonia and treating with sodic phosphate. After standing at least twenty-four hours, the magnesia salts may be filtered off, washed out with ammoniacal water, dried, ignited, and weighed as magnesium pyro-phosphate.

(10) The filtrate E, which should not be more than 10 or 15 cubic centimeters, containing the carbonates of the alkalies, is evaporated to dryness and gently fused so as to render insoluble any magnesium carbonate that may have gone through; then redissolved and filtered into a small weighed platinum dish containing a few drops of hydrochloric acid, to change the carbonates into chlorides; evaporated to dryness, exposed to a gradually rising temperature (below red heat), by which the chlorides are thoroughly dried and freed from moisture so as to prevent the decrepitation that would otherwise occur on ignition. Then, holding the platinum basin firmly by forceps grasping the clear edge, pass it carefully over a very low Bunsen flame, so as to cause, successively, every portion of the scaly or powdery residue to collapse without fully fusing. There is thus no loss from volatilization, and no difficulty in obtaining an accurate, constant weight.

The weighed chlorides are now brought by means of a little water into a small beaker or porcelain dish, treated with a sufficient quantity of platinic chloride, and evaporated to dryness over the water bath. The dried residue is treated with a mixture of three parts alcohol and one part ether, leaving the potassio-platinic-chloride undissolved. This is put on a filter and washed with ether-alcohol. When dried the precipitate and filter are put into a small platinum crucible and exposed to a heat sufficiently intense to reduce the platinum chloride to metallic platinum and to volatilize the greater part of the potassium chloride. This is easily accomplished in a crucible which is roughened by being constantly used for the same purpose (and no other), the spongy metal causing a ready evolution of the gases.

The reduced platinum is now first washed with hot acidulated water, then with pure water, then all moisture is driven off and it is weighed. From the weight of the platinum is calculated the *potassic chloride* and the oxide corresponding; the difference between the weights of the total alkaline chlorides, and the potassic chloride gives the sodic chloride from which may be calculated the sodic oxide.

II.—Phosphoric acid determination.

(11) The weighed quantity of 3 to 5 grams is ignited in a platinum crucible, care being taken to avoid all loss by dusting. The loss of weight after full ignition gives the amount of chemically combined water and volatile and combustible matter.

(12) The ignited soil is now removed to a porcelain or glass beaker, treated with four to five times its bulk of strong nitric acid, digested for two days, evaporated to dryness first over the water bath and then over the sand bath; moistened with nitric acid, heated and treated with water. After standing a few hours on the water bath it is filtered off from the insoluble residue and the filtrate is evaporated to a very small bulk (10 cubic centimeters) and treated with about twice its bulk of ammonium molybdate, thus precipitating the phosphoric acid. After standing at least twelve hours, at first on the steam bath, it is filtered off and washed with a solution of ammonium nitrate acidified with nitric acid. The washed precipitate is dissolved on the filter with dilute ammonia. After washing the filter carefully the ammoniacal solution is treated with magnesia mixture, by which the phosphoric acid is precipitated. After allowing it to stand twenty-four hours it is filtered off, washed in the usual way, dried, ignited and, weighed as magnesium pyrophosphate, from which the phosphoric acid is calculated. The per cent of phosphoric acid found is to be subtracted from that of the alumina.

Note.—When a gelatinous residue remains on the filter after dissolving the molybdo-phosphate with ammonia, it may consist either of silica not rendered fully insoluble in the first evaporation, or, more rarely, of alumina containing phosphate. It should be treated with strong nitric acid, and the filtrate with ammonic molybdate. Any precipitate formed is of course added to the main quantity before precipitating with magnesia solution.

About 10 grams of soil are weighed off into a prepared filter. The soil should be covered with a piece of paper (filter), so as to prevent it from packing when solvents are poured on it.

It is now treated with hydrochloric acid from 0.5 to 1 per cent strong (25½ cubic centimeters of strong acid and 30 cubic centimeters of water), to dissolve out the lime and magnesia, which prevent the humus from dissolving in ammonia. Treat with the acid until there is no reaction for lime; then wash out the acid with water to neutral reaction. Dissolve the humus with weak ammonia water, prepared by diluting common saturated ammonia water (173 cubic centimeters ammonia to .22 water). Evaporate the humus solution to dryness in a weighed platinum dish at 100, C.; weigh, then ignite. The loss of weight gives the weight of humus.

The residue from ignition is carbonated with carbonic gas, heated, and weighed, thus giving the ash. It is then moistened with nitric acid and evaporated to dryness. The residue is treated with nitric acid and water, allowed to stand a few hours, and the solution filtered from the insoluble residue, which is ignited and weighed, giving the silica.

The "soluble" phosphoric acid is determined from the solution by the usual method, as magnesic pyrophosphate. It usually amounts to a fraction varying from one-half to as little as one-tenth of the total in the soil.

While the P_2O_5 so determined is manifestly more soluble and more available to vegetation than the rest of that found by extraction with stronger acid, it is clearly not as available as that which, when introduced in the form of superphosphates, exerts such striking effects, even though forming a much smaller percentage of the whole soil. Nevertheless, very striking agreement with actual practice is often found in making this determination.

The estimation of "humus" by combustion in any form of the total organic matter in the soil gives results varying according to the season, and having no direct relation to the active humus of the soil.

It is strenuously suggested that in the presentation of the results of a soil analysis the order of the electrolytic series be observed, as in the schedule annexed, so as to facilitate comparisons. The "insoluble residue" is best placed at the head of the column, as it indicates at a glance, approximately, the general character of the soil, as sandy or clayey.

For suggestions concerning the interpretation of analyses made according to the above method see "Report on the Experiment Stations of the University of California," 1890, pp. 151–172.

Suggested Experiments in Breeding.

By William H. Brewer, *of Connecticut.*

Practical breeding has become a greatly specialized art, and the natural laws involved are a very fit subject for experimental study at the stations. Although the general rules seem to be fairly well understood, nevertheless some of the fundamental laws of breeding are not yet established, and will not be until proved by experiments made for this special end by trained biologists working according to scientific methods.

For example: It is almost universally believed by practical breeders that "acquired characters" are sometimes, or at least to some degree, transmitted by heredity, and they practice accordingly. This belief has been so widely shared by scientists that until lately it has been a sort of scientific dogma.

Within a few years, however, this dogma has been questioned by a large number of very eminent biologists, many of whom deny it in toto and claim that from the very nature and basis of heredity such transmission can not take place under any circumstances nor to any degree whatever.

Between the two extremes there is a considerable following which allows the possibility of the heredity of "acquired characters," but denies that it has any practical value in the evolution of species in nature, and consequently plays no part in the improvement of breeds by art.

This uncertainty is so far-reaching in its applications and so important in its economic results that I suggest a few series of experiments to be made at agricultural experiment stations. The costly character of the best stock used in practical breeding and the cost of the means and appliances for breeding in its most advanced practice place this out of reach of the stations. The experiments I suggest may be carried out with some small and inexpensive species of domestic animals. The experiments had better be made with mammals than with poultry, and the laws involved can be as well established by experiments on rabbits, guinea pigs, or even rats and mice, as with the most expensive trotters or short-horns.

The eminent Prof. August Weismann and his followers claim that none of the changes produced on an animal after its birth are ever transmitted by heredity to its offspring, even in the slightest degree; that the changes in the parent due to nutrition, those which follow from increased or diminished function, the effects of mutilation, injury, and disease—in short, of "any of the external influences which act upon the body"—never are, and never can be, by any possibility, transmitted; that the fundamental causes of heredity absolutely forbid it.

I have yet to find the successful breeder who accepts this as an established law of nature, nor is it accepted by all biologists. I think, therefore, that experiment stations, established for the investigation of natural laws of economic importance, should undertake experiments to find out what is the law involved in such cases. I would suggest that the experiments be carried along in at least two parallel lines, one to determine the effect of nutrition, the other of function. These would be the easier and of more obvious application to the average practical breeder.

If rabbits, for example, are chosen for experiment, I would recommend that the beginning be made with a sufficiently large number of animals so that the breeding need not be very close, and that the original stock consist of several breeds, half a dozen or more, their blood to be variously mixed by crossing as the experiments go on in order that the mongrel produce may have a greater tendency to vary under the conditions imposed than if but one original breed was used whose characters were well fixed and more liable to breed true to the parent type.

Let two sets from the same stock be bred separately and the experiments carried on along two parallel lines; the one well fed during growth, that the mature animals may be of good and full size; the other be stunted during growth by under feeding. Consider this for a considerable number of successive generations, ten or fifteen at least, the one series continually well fed, the other continually under fed, and carefully record the results during the progress. Also keep a record of the number of each produced, that one phase of the mooted question of the causes of sex may be investigated at the same time.

Inasmuch as the whole increase of the flock could not be kept in the reducing of the numbers from time to time great care should be used that selection as to size be not practiced; they should be selected by averages, by weighing, or in some other satisfactory way.

The outcome of such a series of experiments would be of vast importance ultimately in determining the natural laws which underlie the best treatment for growing animals intended for breeding.

For determining the influence of the exercise or disuse of function another series is requisite. Function may be impaired by disuse, by injury, or by mutilation, by disease, or by other causes.

The most convenient and, for various reasons, the best way would be to impair function by mutilation. Suppose we use rabbits (as in the previously suggested experiments), beginning with a considerable number of breeds, and crossing until

one had a mongrel stock of the different breeds variously intermingled. Let us, from the beginning, amputate some one limb, soon after birth, of all the animals, always amputating the corresponding limb (say the left foreleg or the right hindleg, not the left of one animal and the right of another, but always the corresponding limb). Pursue this for at least ten or fifteen successive generations, and record the results. Some other injury might be more convenient, as the extirpation of an eye, inasmuch as there are several recorded cases of alleged transmissions of injury to the eye.

If mutilation be objected to, then resort to the more troublesome process of preventing use. Tie up or in some other way prevent the use of one limb or the use of one eye, from birth on, and note the effect, if any, on successive generations.

While such interference with function is not precisely the reverse of exercise and training (as shown in the development of speed in trotters and milk in cows), yet the laws involved are the same and would be of great scientific interest as well as of practical importance.

It seems to me that experiments on the removal of some organ of little use to the animal in domestication, such as cutting off the tail or an ear, would not fulfill the best condition for experiment. There is too little function involved.

A number of other lines of experiment readily suggest themselves; but I have long had this matter in mind, and on the whole, the directions I have indicated seem to me the most practicable, fair, and the most promising of results, and there can be no complete science of breeding until the fundamental laws are established.

While on this subject, I wish to suggest a line of observations to be recorded at those stations where cows are bred and where milk is tested. There is much assertion, but I know of no extensive recorded observations, as to the effect produced by the milking of the dam on the milking capacity of the offspring. Let a record be kept of the successive calves of each cow, to see if, on the average, the earlier calves are as good milkers as the later ones; if there is any difference, wherein does it lie? Observations on the offspring of any one cow are of little value; recorded observations on many would be of much value in establishing a rule.

Ramie culture in the South.

By C. R. Dodge, *of Washington, D. C.*

Will it pay Southern farmers to cultivate ramie? is a question easier to ask than to answer. At the very outset, we may reply emphatically "No," until a satisfactory machine decorticator or process has been presented that will produce the fiber at a cost allowing competition with the imported China ramie of commerce. But it is not my purpose to speak of the machine question at this time. For the sake of argument we will suppose that question settled, though it is not settled by any means.

Now, with a satisfactory machine or process, will ramie culture pay in those States bordering on the Gulf, where the plant is claimed to grow successfully? As far as my investigations have shown, and in spite of the experimental culture of ramie for many years in the South, it is simply impossible to answer the question, because these experiments have either been conducted in too superficial a manner with failure inevitable from the industrial standpoint, or they have been upon too small a scale to furnish a basis for reliable estimates. In making such a statement I am aware that figures have been published from time to time purporting to show the actual cost of growing an acre of ramie, but they have not borne the test of careful analysis.

Many claim that ramie culture will not pay. But the claim is also made in the South by others that a field of ramie will take care of itself after once planting, the soil requiring no special cultivation or manuring. Here is what a Southern writer says concerning the crop: "Ramie is preëminently a poor man's crop. It is the

easiest and least expensive in point of labor of all crops to produce." This is absurd. An experimenter said to me not long ago, "We have given up ramie; there is no money in it." But he did not tell me what I afterwards learned, that the roots had been set out in the poorest soil with no manuring, and had been practically allowed to take care of themselves. The owner of one of the largest tracts of ramie in Louisiana, speaking of his operations the present season, admitted to me after harvesting the crop that all his preconceived ideas upon the subject had been upset, and he was beginning to see where mistakes had been made.

The grain of wheat in all this peck of chaff is that before making any positive statements concerning the cost of ramie cultivation in the United States experiments must be conducted on a large scale for several seasons under most careful supervision, and the conditions of successful growth intelligently studied as they have never been studied in this country.

By successful growth I do not mean the ability of the plant to shoot up stalks of requisite height and to clothe these stalks with a healthy growth of leaves, but to ascertain if such stalks contain proper spinnable fiber after having been grown, and in sufficient quantity per acre to yield an adequate return for the expenses of cultivation and the subsequent expenses of extracting the fiber and degumming it for the spinner. A stalk of ramie either grows rapidly and rankly when there is an excess of moisture, or it is stunted and of slow growth when opposite conditions prevail.

Where one of these conditions follows the other in the same growing crop, the fiber is adversely affected, for, in the after processes to fit it for spinning, treatment necessary to reduce the hard or stunted growth to the condition of spinnable fiber may wholly disintegrate the structure of the fiber in the softer or free-grown portion of the stalk, and great wastage and loss ensue. Or, the stalks in one part of the field may produce one grade of fiber and those on another portion a different grade, or the crops from two cuttings may differ in the same way. An acre of ground should produce 10 to 15 tons of stalks with leaves; say 12½ tons average, of 25 tons for two annual cuttings. French experiments have shown that every ton of stalks and leaves when properly treated will give about 25 pounds of the chemically degummed fiber fit for spinning. Records of these experiments show that this 25 pounds of fiber has cost for culture, cleaning, and degumming not over $3. Multiply this by 25, the product of 25 tons of stalks with leaves, and we have a total of 625 pounds of spinnable fiber that have cost for cultivation and treatment, including chemical degumming, $75. Yet only a few days ago I saw a published statement that the income to a Southern farmer for cultivation alone would amount to $150 per acre.

Before the farmers of the South may be induced to go into ramie culture, several points should be settled that can not be settled by indifferently conducted experiments, or by cultivation on garden plot areas:

(1) How many tons of stalks per acre can be regularly produced?

(2) What quantity of spinnable fiber will an acre produce?

(3) What methods of cultivation, drainage, irrigation with soil selection, or selection of location, will be necessary to produce an even quality of spinnable fiber one crop with another or in the same crop; and lastly, these questions having been satisfactorily answered, what profit will the balance sheet show between cost of cultivation and harvesting, and price that the spinner will pay for the degummed fiber? This, in short, means a connected study of the whole field of operations, culture, the machine problem or the cleaning of the fiber, and degumming, because the price of the commercial China grass, imported without duty, fixes the price of all fiber. The question may be asked, Why include the degumming, and why not stop with the machine-cleaned fiber, as the degumming is a part of the manufacturing process? I will reply that in the hand preparation of commercial ramie by the Chinese the product is partially degummed, and that the machine-prepared fiber in all prob-

ability will never bring the same price per pound as the Chinese for this reason. When the economically successful machine has been placed on the market, and careful field tests have shown the quality and quantity of the output we will know something more than is known now concerning the money value of machine-cleaned fiber, and it will not then be a difficult matter to say what the farmer's share of the ton value of the fiber will be.

Such connected study has been given to the industry in France, followed by valuable practical results, that have made it a recognized industry. The French figures of cultivation are available for our study and guidance, but they do not settle the various problems as regards cultivation in America where such different conditions prevail. We must therefore work out these problems for ourselves.

While these facts are in a sense discouraging, there are some most encouraging features. In the first place my recent investigations have shown that American experimenters degum the China ramie at almost half the cost at which it is degummed in France with a loss by waste of only 5 per cent against 30 to 40, as shown by the French records. If this saving can be made with China grass it can be made with the home grown product, which would mean more spinnable fiber to the ton of stalks, and at a less cost. One of the great expenses of harvesting the crop, the stripping of the leaves, will eventually be accomplished by the machine which strips the fiber, and France already has a machine that has shown promising results and which takes the stalks, leaves and all. And, finally, should a careful system of experiment demonstrate that we can produce good fiber at a paying cost, there is no doubt at all concerning the market. The absence of a regular supply of fiber, in the past, has been one of the chief obstacles that has hindered the manufacturing side of the industry, though there is now a better supply. Ramie goods are purchasable to-day in New York city, manufactured in France by a concern which runs over 5,000 spindles, and I know that capital on this side of the water is already interested in establishing manufacturing plants on a large scale. Their supply of the raw material must be derived from China, but Southern ramie will have equal chance when it has been demonstrated that we can produce good fiber at a cost that will enable its use economically.

The Government share in this work is to secure all available information, from every source, and disseminate this information through its publications, and by correspondence in answer to personal inquiry.

THE SECTION ON HORTICULTURE.

A meeting of the Section on Horticulture was called, but it appeared that only four members were present. An invitation having been received from the Section on Botany for the members of the Section on Horticulture to meet in joint section with them, it was thought best to accept it, and accordingly the two sections held their meetings in conjunction throughout the convention.

By a revision of the constitution the Sections on Horticulture and Botany were consolidated, hence the two sections will in the future meet together, forming a single section.

THE SECTION ON BOTANY.

The Section on Botany organized at 7:30 p. m. November 15.

In the absence of the chairman Prof. P. H. Mell, of Alabama, was elected chairman *pro tem.*

The horticulturists were invited to meet with the Botanical Section. The following persons were present at the different sectional meetings: Halsted of New Jersey, Earle, Tracy, and McKay of Mississippi, Mell and Duggar of Alabama, True of Washington, D. C., Goff of Wisconsin, Woods of Connecticut, Speth of Georgia, Munson of Maine, Scribner of Tennessee, McCluer of Illinois, Neal of Oklahoma, Gulley of Arizona, Osborn and Pammel of Iowa, Warder of Ohio, and F. H. Burnette of Louisiana.

A committee of three, consisting of Messrs. Scribner, Goff, and Pammel, was appointed to consider the papers in hand. The following papers were referred for reading at the general session:

Notes on the treatment of apple scab, by E. S. Goff; Results of spraying potatoes for prevention of blight, by L. R. Jones; Fruit rots, a study, by B. D. Halsted; Notes on the breeding of fruits, by N. E. Hansen; Crossing of cucurbits, by L. H. Pammel.

On November 16, at 10:30 a. m., the section was favored with a talk on the laboratory exhibit of botany and horticulture at the Columbian Exposition by Mr. True, and on the work for the botanical alcove by Mr. Tracy.

On November 17, at 7 p. m., Mr. Halsted acted as chairman and the following papers were presented before the section:

Bean anthracnose and its treatment, by S. A. Beach.—Various fungicides like Bordeaux mixture and cupric borate were experimented with. It was also shown that plants from healthy seed were better than those of diseased seed. At the time of first picking they were ahead by thirty-eight points on yield by pods, forty points on yield by weight, and seventy-five points on condition of foliage; but for the entire season the difference was but nine points, seventeen points, and eight points respectively.

Some experiments in the prevention of Cercospora ribis and Cylindrosporium padi, by L. H. Pammel.—Attention was called to the successful application of Bordeaux mixture, half strength during the season of 1892.

Ammoniacal carbonate of copper half strength and sulphosteatite, as a powder, failed to be as valuable as Bordeaux mixture for the treatment of currants. Those treated with the latter mixture retained their foliage well in October. *Cylindrosporium padi* on cherries can easily be prevented by the use of Bordeaux mixture. Mr. Goff also found Bordeaux mixture valuable for currants.

Quince disease, by B. D. Halsted.—The following fungous troubles of the quince fruit were treated, namely: the quince rust (*Rœstelia aurantiaca* Pk.); fruit spot (*Entomosporium maculatum* Lev.); black rot of the quince (*Sphæropsis malorum* Pk.); quince pale rot (*Phoma cydoniæ* Sacc.?); ripe rot of the quince (*Glœosporium fructigenum* Berk.), and the quince blotch, due to an unrecorded fungus, the life history of which is still obscure. The black rot is the same as that of the apple, and the fact that a large apple tree had the ground beneath it covered with rotting apples, doubtless had much to do with the prevalence of the rot in the quinces. The pale rot may not be *Phoma cydoniæ* Sacc., the description being so meager as to leave a doubt. The ripe rot is the same as that of the apple, as proved by inoculation.

Antagonistic relations of certain potato rots, by L. R. Jones.—He called attention to the great abundance of *Phytophthora infestans* in 1890, 1891, and 1892. There are three common blights in Vermont. *Phytophthora infestans* does its greatest damage on medium and late potatoes. The "new disease" destroyed the potato vines by the first week in August before the conditions of weather were such as to favor the development of *Phytophthora*.

Preliminary notes on rutabaga and turnip rot, by L. H. Pammel.—A disease doing considerable damage, in some cases destroying half the crop, occurred on the Iowa Agricultural College Farm. Dry weather in September almost checked the progress of the disease. The disease is due to a bacterium. Several germs were isolated and one apparently produced the disease in the field. But this is not conclusive evidence that it is the specific germ, as the experiments carried out do not conform to all of the Koch canons.

A new "damping off" fungus, by George F. Atkinson.—A sterile mycelium of a fungus which causes "damping off" of cotton, *Dolichos sinensis*, cauliflower, alfalfa, etc., was isolated. The fungus was grown in nutrient media and young plants inoculated producing the characteristic "damping off." From these plants the fungus was again obtained. The fungus is probably a member of the *Hymenomycetes* or *Discomycetes*.

Relation of frost to certain plants, by L. H. Pammel.—In this paper the exact temperatures at which various plants were affected by frost were noted. In some cases parts of a plant close to the ground were affected while the upper were not injured as in castor-oil bean (*Ricinus communis*). On October 18 the minimum temperature close to the ground was 18° F. Five feet from the ground it was 36° F.

New Jersey mildews (*Peronosporeæ*), by B. D. Halsted.—The chief point in the record for the year is, that while the latter portion of the growing season has been unusually dry, there has been more than the ordinary amount of those members of the group belonging to the genus *Cystopus*. In a further study of the methods these disastrous mildews have for passing the winter, it was found that some species grow upon the fruits and that doubtless the filaments of the fungus penetrate the seeds and when the latter germinate the parasite develops with the host. Large numbers of small young seedlings were taken that were badly infested.

The importance of making field notes upon the prevalence of parasitic fungi extending over many seasons was urged.

Weed seeds, by B. D. Halsted.—Samples of a collection of weed seeds were shown. The set consists of one hundred species of our worst weeds, and the seeds are put up in dram, metal screw-top, vials arranged in a tray, about the size of a herbarium sheet. Each bottle has a printed label, bearing a number and the botanical name of the seeds contained. To the inside of the tray cover is pasted a corresponding list with common names added, and whether the species is native or foreign, and whether annual, biennial, or perennial. The set is designed to assist experiment station workers in determining the nature of foul stuff in commercial seeds. It will also serve the same purpose for the wholesale dealers in seeds.

Method of obtaining pure cultures of Pammel's fungus of Texas root-rot of cotton, by Geo. F. Atkinson.—It is difficult to grow many fungi in nutrient media, and this is one of them. Several attempts were made to induce this fungus to part with its host. When grown in sand in moist chambers the strands grew several inches long, but they failed to grow in nutrient media when transferred. Baits were provided and after some difficulty the fungus was obtained in a pure state.

The section nominated Mr. F. Lamson-Scribner, of Knoxville, Tenn., for chairman, and Mr. E. S. Goff, of Madison, Wis., secretary.

The section then adjourned.

GEO. F. ATKINSON,
Chairman, Ithaca, N. Y.
L. H. PAMMEL,
Secretary, Ames, Iowa.

INDEX.

NAME LIST.

Aldrich, J. M., 50.
Allen, E. W., 15.
Alvord, H. E., 11, 12, 15, 16, 21, 23, 24, 28, 58, 66, 71, 72, 73, 75, 77, 78, 79, 80, 84, 87, 97, 98, 103, 104, 106, 107, 108, 109, 110, 113, 116, 119, 122, 124, 126.
Alwood, W. B., 35, 50.
Anderson, D. S., 14.
Anderson, F. P., 12, 110.
Armsby, H. P., 15, 18, 22, 74, 98, 99, 102, 107, 111, 124.
Arthur, J. C., 34.
Atherton, G. W., 15, 21, 22, 24, 74, 80, 85, 103, 111, 112, 117, 120, 122, 124, 125.
Atkinson, G. F., 11, 17, 18, 19, 33, 34, 35, 42, 169, 170.
Ayres, B., 14.
Babcock, S. M., 111.
Barrow, D. N., 14.
Battle H. B., 18, 40.
Beach, S. A., 34, 168.
Beaver, J. A., 85.
Beckwith, M. H., 43.
Bessey, C. E., 34.
Black, S. E., 15.
Blouin, R. E., 14.
Bolley, H. L., 19, 34.
Bondurant, A. J., 13.
Brewer, W. H., 18, 130, 162.
Broun, W. L., 11, 13, 17, 19, 21, 58, 79, 120.
Bruner, L., 11, 12, 18, 41, 51.
Brunk, T. L., 11.
Buchanan, J. B., 15, 79.
Buchanan, W. I., 22, 99, 100, 103.
Buckhout, W. A., 34.
Budd, J. L., 73.
Burnette, F. H., 14, 163.
Burrill, T. J., 34.
Burrus, J. D., 14.
Burwell, R. T., 14.
Butler, T., 14.
Butterfield, I. H., 14.
Cameron, John, 85.
Carpenter, L. G., 13, 18, 130, 142.
Cavitt, W. R., 15, 79, 85, 126.
Chamberlain, H., 14, 21, 85.
Chester, F. D., 33.
Clute, O., 14, 56, 86, 118.
Coleman, J. W., 15.
Collingwood, C. B., 38.
Comstock, J. H., 49.
Cook, A. J., 47.
Cooke, W. W., 15, 18, 101, 129.
Cooper, W. J., 14.
Craig, M., 34.
Crawley, J. T., 14.
Cross, J. L., 14.
Curtis, G. W., 15, 18, 67, 71, 129.
Dabney, C. W., jr., 11, 12, 15, 40, 75, 78, 79, 102, 103, 106, 109, 110.
Dale, H. B., 15, 85.
Davidson, R. J., 41.
Deiler, J. H., 14.
De Pass, J. P., 13, 76, 78, 110, 117.
Detmers, F., 34.
Dillard, J. H., 14.
Dixon, B. V. B., 14.
Dodge, C. R., 130, 164.
Doran, E. W., 46.
Dougherty, N. S., 15.
Dudley, W. R., 33.
Duggar, B. M., 13, 168.
Earle, F. S., 14, 168.
Emery, F. E., 11.
Fairchild, D. G., 34.
Fairchild, G. T., 13, 27, 52, 53, 67, 86, 110, 113, 116, 117, 122.
Farrington, E. H., 38.
Fernald, C. H., 46.
Fernald, M. C., 12, 14, 53, 70, 73, 110, 121.
Ficklen, J. B., 14.
Fitzpatrick, J., 19, 21.
Flagg, C. O., 15.
Fletcher, J., 51.
Forbes, S. A., 44.
Fortier, A., 14.
Foster, L., 18.
Foster, M. J., 19, 21.
Frear, W., 11, 15, 73, 112.
Gardner, F. D., 18.
Garman, H., 34, 45.
Georgeson, C. C., 13, 18, 67, 129, 145.
Gibson, H., 85.
Gill, C. T., 14.
Gillette, C. P., 43.
Goessman, C. A., 39.
Goff, E. S., 12, 15, 35, 51, 87, 110, 168, 169, 170.
Goodell, H. H., 11, 12, 14, 24, 103, 109, 111, 120, 125.
Goss, A., 40.
Grange, E. A. A., 101.
Gulley, F. A., 13, 18, 67, 80, 85, 111, 129, 147, 168.
Hadley, H., 14, 24, 72, 73, 74, 76, 78, 86, 103, 113, 121, 122.

Hall, C. W., 12, 14, 57, 110, 137.
Hall, T. T., 14.
Halsted, B. D., 14, 18, 19, 34, 91, 163, 169, 170.
Hansen, N. E., 92, 167.
Hardin, M. B., 40.
Harrington, H. H., 11, 40, 106.
Harris, A. W., 15, 17, 80, 81, 84, 85, 87, 98, 99, 106, 125.
Harvey, F. L., 34, 46.
Harwood, P. M., 14, 18, 52, 67, 71, 129, 130.
Hays, W. M., 15, 18, 52, 108, 110, 129, 130, 132.
Henry, J. M., 14.
Henry, W. A., 11, 12, 15, 17, 18, 53, 57, 67, 80, 85, 87, 102, 109, 110, 111, 129.
Hickman, J. F., 11, 15, 18, 109.
Hilgard, E. W., 11, 18, 67, 106, 109, 135, 156, 158.
Hill, H. A., 14.
Hillman, F. H., 48.
Hills, J. L., 41.
Hitchcock, A. S., 33, 34.
Holcombe, J. W., 15, 18, 113, 118, 119, 122, 123.
Holladay, A. Q., 11, 15, 109.
Holt, John, 147.
Holter, G. L., 40.
Hopkins, A. D., 51.
Huggins, J., 13.
Humphrey, J. E., 33, 34.
Hunnicutt, J. B., 13, 73.
Hunt, T. F., 11, 15, 18, 24, 76, 110, 113, 119, 120.
Hurt, A. D., 14.
Huston, H. A., 13, 39.
Hutchinson, T. P., 14.
Hutchinson, W. L., 39.
Ingersoll, C. L., 11, 14, 18, 28, 33, 52, 67, 129, 138.
Jamieson, H., 14.
Jenkins, E. H., 38.
Johnson, A. A., 15, 82, 87.
Johnson, S. W., 12, 13, 71, 83, 86, 87, 109.
Johnston, W. P., 14, 19, 21.
Jones, L. R., 35, 88, 168, 169.
Jordan, W. H., 11, 18.
Keffer, C. A., 47.
Kellerman, W. A., 33.
Kilgore, B. W., 15.
King, F. H., 15, 18.
Kinney, L. F., 35.
Latta, W. C., 12, 110, 129.
Lee, J. G., 14.
Lee, S. D., 14, 27, 52, 54, 55, 56, 98, 103, 108, 109, 110.
Lloyd, E. R., 14.
Loughridge, R. H., 13, 103, 129, 156.
Lugger, O., 47.
Lupton, N. T., 13.
McCarthy, G., 19, 34.
McCluer, G. W., 13, 163.
McGee, W. L., 14.
McKay, A. B., 14, 163.
McLaren, D., 18.
McNeill, J. F., 43.
Mell, P. H., 13, 33, 168.
Merry, J. F., 15, 106, 125.
Miller, R. H., 14, 126.
Morgan, H. A., 13, 45.
Morrill, J. S., 108.
Morrow, G. E., 13, 18, 22, 67, 102, 103, 104, 105, 106, 124, 125, 129.
Morse, F. W., 39.
Munson, W. M., 14, 163.
Murfee, E. H., 13.
Murray, W., 15.
Myers, J. A., 11, 15, 79, 80, 85, 109, 111.
Needham, D., 85.
Newman, J. S., 15, 18, 24.
Neal, J. C., 15, 120, 168.
Neale, A. T., 11, 13, 80, 85, 111.
Neilson, James, 12, 14, 76, 78, 82, 103, 109.
Nicholson, J. W., 11, 13, 97.
Nickerson, W. J., 14, 73.
Niswander, F. J., 51.
Northrop, C., 126.
O'Brine, D., 38.
Orcutt, I. H., 50.
Ordway, J. M., 14.
Orr, H. B., 14.
Osborn, H., 13, 41, 44, 110, 125, 163.
Palmer, B. M., 21.
Pammel, L. H., 11, 13, 19, 34, 92, 94, 125, 163, 169, 170.
Paquin, P., 101.
Patrick, G. E., 39.
Patterson, H. J., 14, 18, 39, 120, 150.
Patterson, J. K., 13, 74.
Pearce, J. W., 14.
Pendergast, W. W., 137.
Perkins, G. H., 50.
Peter, Robt., 156, 158.
Phelps, C. S., 18.
Plumb, C. S., 13, 52.
Popenoe, E. A., 11, 45, 52.
Porter, E. D., 14, 116, 117, 118.
Price, R. H., 35.
Quick, W. J., 13, 110, 129.
Redding, R. J., 13, 84, 85, 87.
Richman, E. S., 50.
Riley, C. V., 42, 43.
Roberts, I. P., 15, 18, 87, 103, 108, 109, 111, 118, 129.
Rogers, W. O., 14.
Rolfs, P. H., 33, 44.
Ross, B. B., 13.
Roussell, J. N., 14.
Roy, V. L., 14.
Rynerson, W. L., 14, 79, 85.
Sanborn, J. W., 15, 18, 27, 52, 53, 55, 99, 109, 110.
Scott, Austin, 14, 75, 78, 85, 103, 115, 116, 117, 120, 125.
Scovell, M. A., 11, 12, 13, 21, 22, 24, 35, 41, 73, 78, 101, 109, 111, 129.
Scribner, F. L., 12, 15, 35, 110, 168, 170.
Sharp, R., 14.
Shaw, G. W., 40.
Slosson, E. E., 41.
Smart, J. H., 13, 22, 24, 55, 78, 97, 103, 111, 112, 121, 122, 125.
Smith, C. D., 18.
Smith, J. B., 48.
Smyth, E. A., jr., 35.
Snow, F. H., 45.
Snyder, H., 39.
Soniat, Lucien, 14.
Speth, G., 13, 168.
Stockbridge, H. E., 11, 126.
Stubbs, W. C., 11, 14, 21, 24, 109, 110, 124, 125, 129.

Sturgis, W. C., 33.
Silvester, R. W., 126.
Teller, G. L., 38.
Thorne, C. E., 15, 18, 101, 102, 103, 129, 139.
Toumey, J. W., 33, 42.
Townsend, C. H. T., 49.
Tracy, S. M., 14, 18, 33, 34, 88, 102, 110, 168.
Troop, J., 44.
True, A. C., 15, 168.
Turner, E. M., 11, 15, 18, 24, 27, 52, 67, 71, 73, 77, 108, 120.
Vanderford, C. F., 15, 129.
Vasey, G., 18.
Von Phul, W., 14.
Voorhees, E. B., 18.
Waldron, C. B., 49.
Walker, F. A., 126.
Warder, R. H., 15, 85, 163.
Washburn, F. L., 49.
Washburn, J. H., 15, 121.
Waters, H. J., 18.
Webster, F. M., 11, 12, 49.
Weed, C. M., 48.
Weed, H. E., 14, 47, 48.
Wheeler, C. F., 33, 34.
Wheeler, H. J., 40.
Whitcher, G. H., 14.
Whitney, M., 18, 106.
Willits, E., 98, 99, 106.
Wilson, J., 18.
Wilson, N. E., 14.
Wiley, H. W., 15, 103, 125.
Williams, T. A., 35.
Williams, W. L., 101.
Wing, H. H., 15, 18, 67, 101, 103.
Woll, F. W., 15.
Woods, C. D., 13, 38, 73, 77, 168.
Woodward, W., 14.
Woodworth, C. W., 43.
Wooten, E. O., 34.

SUBJECT LIST.

Page.

Advances in agricultural education 132
Advisory board to committees on college and station exhibits at World's Columbian Exposition. 79, 85
Agricultural Congress at World's Columbian Exposition, report of committee 104
education, advances in 132
experiment stations, list of directors 3
science, resolution indorsing 125
Agriculture and chemistry, minutes of section 129
officers of section 110
programme of section 18, 67
report of section 28
U. S. Department of, resolution of coöperation 112
what shall professors of, teach 139
Analysis of soils, methods 158
Annual address of president 58
dues of institutions 108
Apple scab, treatment 87
Association of American Agricultural Colleges and Experiment Stations—
call for convention 16
change of title 76, 78
constitution 7
revision of 71
election of officers 109
local programme 19
number and length of sessions 109
officers 11
programmes of meetings 17
report of executive committee 21
report of treasurer 24
Auditing committee, appointment 24
report 113
Bibliographer, duties 77
Botany, minutes of section 168
Botany, programme of section 18
report of section 33
Breeding of fruits 92
suggested experiments in 162
Bureau of Education, form of schedule required by 116
relation of colleges to 114
editing and publishing reports of presidents of colleges by 113
resolution on work of 124
Bust of Hon. J. S. Morrill, resolution for placing in libraries 98, 108
Call for convention 16
Chemistry and Agriculture, minutes of section 129
report of section 36
College exhibit at World's Columbian Exposition, report of committee 107
statistics, committee to collate 24
work, officers of section 110
report of section 24
discussion on 52
Colleges, editing and publishing reports by Commissioner of Education 113
report of committee on statistics of 111
time and number of reports required 122
Comparative test of fungicides in checking potato blight and rot 89
Constitution of Association 7
revision 71
Convention, call for 16
invitation to hold at Ames, Iowa 125
in Texas 120
time and place of 21

Page.
Conventions, resolution to confine programmes to administrative and experimental questions...99, 109
Coöperation with U. S. Weather Bureau, report of committee 106
Courses of study, the relation of general to technical 67
Courtesies, committee for acknowledging 98, 103
Crossing of cucurbits 94
Delegates, list of 13
number of votes one may cast 72
Dues of institutions 108
Editing and publishing of reports of presidents of colleges by the Bureau of Education 113
of proceedings 112
Election of officers 109
Entomology, officers of section 110
report of section 41
Executive committee, report 21
Exhibit of stations at the World's Columbian Exposition, report of committee 99
Exhibit of colleges, report of committee 103
Experimentation, the establishment of official methods 147
Experiments in breeding 162
Forage plants for the semi-arid West 145
Fruit decays, a study 91
Fruits, notes on breeding 92
Fungicides, comparative test in checking potato blight and rot 89
Grass gardens, methods and purposes 130
Horticulture and botany, officers of section 110
minutes of section 167
report of section 52
Intercollegiate statistics, report of committee 111
Interior, Department of, relation of colleges to 114
Invitation to hold next convention at Ames, Iowa 125
in Texas 126
to organizations to sit as delegates 24
to visit Louisiana State University and A. and M. College 97
rice mills 124
Southern University 24
Irrigation, methods 142
Lectures in connection with agricultural exhibit 108
Length and number of sessions of convention 109
List of delegates and visitors 13
Live weight of an animal 150
Local programme 19
Mechanic arts, officers of section 110
section on 74
Methods of analysis of soils 158
irrigation 142
Minutes of section on Agriculture and Chemistry 129
Horticulture 167
Botany 168
Morrill, Hon. J. S., bust to be placed in libraries of agricultural colleges 98, 108
Nominating officers, committee on 103
Notes on the breeding of fruits 92
Office of Experiment Stations, card index of 125
resolutions on work of 124
Officers of Association 11
election of 109
committee for nominating 103
sections, election of 110
Official method of experimentation, the establishment of 147
Physical test of soils 156
Potato blight and rot, comparative test of fungicides in checking 89
President, annual address 58
Programme, general sessions 17
local 19
resolution to confine to experimental and administrative questions 99, 109
section on Agriculture 18
Botany 18

	Page.
Programmes of sections	18
Publications, station, numbering	80, 82
title-paging of	86
Purdue University, invitation to southern visitors en route to World's Columbian Exposition	125
Proceedings of convention, editing of	112
Ramie culture in the South	164
Regrets, letters of, from members	126
telegram from Assistant Secretary of Agriculture Willits	98
Relation of technical to general courses of study	67
Report of committee on Agricultural Congress at World's Columbian Exposition	104
coöperation with U. S. Weather Bureau	106
executive committee	21
section on Agriculture	28
Botany	33
College Work	24
Chemistry	36
Entomology	41
Horticulture	52
treasurer	24
Reports of presidents of colleges, time and number required by Department of the Interior	122
Representation, discussion on	72
Resolutions reported by executive committee	79
Revision of constitution	71
Schedule, appointment of committee to arrange with Bureau of Education for annual reports	121
discussion on form	116
Sections, programmes	18
Sessions of convention, number and length	109
Soils, physical tests	156
methods of analysis	158
Southern University, letter of invitation to visit	24
vote of thanks to officers	124
Station exhibit at World's Columbian Exposition, report of committee	99
literature, card index	125
publications, numbering	80, 82
Statistics of colleges and stations, committee to collate	24
report of committee on	111
Study of fruit decays	91
Suggested experiments in breeding	162
Test of dairy cows at World's Columbian Exposition—	
Committee	80, 85, 107
Resolution for editing and publishing results	98
Tests of soils	156
The bulletin, present and prospective	138
The establishment of official methods of experimentation	147
Thanks, resolution of, to the city of New Orleans, press, organizations, etc	124
vote of, to Southern University	124
Title, discussion on change of	76, 78
Treasurer's report, report of auditing committee	113
Treasurer, report of	24
Treatment of apple scab	87
U. S. Department of Agriculture, resolution of coöperation	112
Weather Bureau, report of committee on coöperation	106
What is the live weight of an animal?	150
shall the professor of agriculture teach?	139
World's Columbian Exposition, advisory board to committee	79, 85
agricultural congress, report of committee	104
coöperative station exhibit, report of committee	99
collective college exhibit, report of committee	103
dary tests, record of	98
lectures in connection with agricultural exhibit	108
report of committee to select committee on test of dairy cows	111
test of dairy cows, committee on	80, 85, 107